Understanding and Measuring Child Well-being in the Region of Attica, Greece: Round four

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Abstract
This paper aims to present the results of implementing a new, multi-dimensional and cumulative tool that records the well-being of children in the 1st semester of the school year 2020–2021, which constitutes the fourth round of an ongoing research. The tool was implemented in Attica through questionnaires circulated in twenty-five schools and three support centers for children and families under the organization, “The Smile of the Child” (twenty-eight bodies in total). The total number of children who participated in the sample was 1,114, belonging to three distinct school categories: the 6th grade of elementary school (10–11 years old), the 3rd grade of junior high (13–14 years old), and the 3rd grade of high school (16–17 years old). The results, mapped out in seven clusters, reveal evident concerns over nutrition and the moral education of students. In addition, the results indicate the impact of the COVID-19 pandemic on the well-being of children and reveal with regard to national policy and legislation framework that the status of welfare state in Greece is ineffective and problematic. The theoretical and methodological framework of the study was confirmed through a multiple correspondence analysis (MCA) and a principal component analysis (PCA). The outputs of MCA reflect and confirm the good effect of “The Smile of the Child” for children in need. Finally, an action plan including the creation of policies based on public finance and fuzzy logic was suggested, the most important being the necessity of the establishment of a new Ministry for the protection of child well-being.

Keywords Child well-being · COVID-19 · Measurement · Welfare economics · Public finance · Economic policy · Social policy · Indicators · Action planning · Attica

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1 Introduction

Nowadays, children’s well-being is extremely important for their future success in life as adults, for instance, in terms of academic accomplishment (Kaya & Erdem, 2021). Taking this into account, a primary target of societies should be the achievement of child well-being (Guillén-Fernández & Vargas-Chanes, 2021; Leriou et al., 2021, pp. 3–7), particularly today since it has been adversely affected by the COVID-19 health crisis. Children’s quality of life depends on good polices (Michalos, 2017); thus, societies should work toward securing them.

There are various studies concerning well-being, which are based on either objective or subjective indicators (Michalos & Hatch, 2020; Voukelatou et al., 2021). Child well-being is currently measured with many indicators, the Middle Years Development Instrument (MDI) being the most contemporary on a global level (Guhn et al., 2012; Schonert-Reichl et al., 2011, 2013). A number of other indicators have also been developed, with each approaching the subjective well-being of children differently and stressing, in most cases, life satisfaction (Borualogo & Casas, 2021; Casas et al., 2013; Casas & González-Carrasco, 2021; Dinisman et al., 2012; Huebner & Furlong, 2016; Leto et al., 2021; Llosada-Gistau et al., 2015; Montserrat et al., 2015a; Montserrat, Dinisman et al., 2015a, 2015b; Moreira et al., 2021; Rodríguez de la Vega, 2014; Savahl et al., 2017; Savahl et al., 2021; Viñas et al., 2019). According to Michalos and Land (2018), more emphasis must be given to the subjective indicators of well-being than the objective ones when policies are planned.

In addition, studies into the negative impact of the COVID-19 crisis on the well-being of children have been conducted all over the world, especially by the OECD and the United Nations, particularly UNICEF. According to UNICEF (2021), “To date, children are the hidden victims of the COVID-19 pandemic rather than the face of it.” In addition, UNICEF (2020) has highlighted that “today, more vulnerable children are becoming malnourished due to the deteriorating quality of their diets and the multiple shocks created by the pandemic and its containment measures.” Moreover, the OECD (2020, pp. 4–6) has turned its attention toward children already living in poverty since they will probably be affected more severely by this crisis. Furthermore, the OECD (2020, pp. 7–8) mentions the severe consequences of the pandemic on children’s nutrition, stressing that even prior to the health crisis, there have been many serious problems concerning child well-being globally. In this regard, it encourages countries to implement some actions (Dirwan et al., 2021, pp. 10–16), such as developing a data framework for monitoring outcomes and policies regarding child well-being, ensuring political leadership and commitment for child well-being, etc. The organization also proposes practices so that parents with children are supported, in terms of the COVID-19 health crisis (OECD, 2021). In addition, according to the United Nations (2020), the COVID-19 crisis is having an important effect on child well-being.

Leriou et al. (2021) introduces new indicators on child well-being that are suitable for application in urban centers at the local level, especially in those areas affected by a specific crisis. These indicators are applicable all countries.
including outside Europe. Through these, several research gaps in the field of studies on children’s well-being in Greece have been covered (Leriou et al., 2021). Moreover, by using them, the multi-dimensional estimations of the geographical distribution of the recent deterioration type child well-being (Bougoukos & Fasoulis, 2012, 2013, 2014, 2015; Leriou, 2019; Leriou et al., 2021, pp. 2–3; Papanastatiou et al., 2016) due to the financial crisis (Missos et al., 2022a, Sect. 5; Missos et al., 2022b) in the region of Attica, Greece, were presented for the first time. Specifically, it presented the results of the first round of an ongoing research on child well-being. Three more rounds have been followed.

The research question of this paper is based on deals with the state of child well-being in the light of the COVID-19 pandemic, and how it can be improved. The significance of this research question lies in the fact that in Greece, there are no other scientific studies (Leriou et al., 2021) relevant research institutes, or subject matter dealing with child well-being in universities. More specifically, there is a broader lack of information concerning child well-being in Greece. Due to this gap, children do not have much visibility in the public sphere (Leriou et al., 2022a), which in turn leads to a lack of policies aimed at improving their quality of life.

The main aim of this paper is to present and discuss the results of the fourth round of research via the application of the aforesaid new indicators with regard to the first semester of the school year 2020–2021, in addition to proposing good policies in the framework of an action plan. The paper’s secondary aim is to demonstrate how child well-being is formed in Attica, Greece, in the light of the COVID-19 crisis.

2 The Theoretical Framework

The theoretical framework is the same as that employed in the first round of the research (Leriou, 2015; Leriou & Tasopoulos 2015-2016; Leriou, 2016; Leriou, 2019; Leriou et al., 2021; Tasopoulos & Leriou, 2014). Further, the indicators considered in the analysis are correlated to specific definitions founded, among others, on the welfare economics theory (Leriou, 2015; Leriou & Tasopoulos 2015-2016; Leriou, 2016; Leriou, 2019; Leriou et al., 2021; Tasopoulos & Leriou, 2014). A given definition of child well-being (Fig. 1) must divide its contributing factors into economic and non-economic (Leriou & Tasopoulos, 2015-2016; Leriou, 2016; Tasopoulos & Leriou, 2014), and definitely include Aristotle’s education in virtues to the non-economic well-being (Anderson & Unzicker, 2014, p. 6; Aristotle, 1926, pp. 47–59; Aristotle, 1932, pp. 635–643; Aristotle, 1934, pp. 25–47; Aristotle, 1952, pp. 257–263; Boudouris, 1995, pp. 151–152, 162; Dhéret, 2015, pp. 3–4; Drakopoulos, 1989; Edgeworth, 1881; Jensen, 2015; Keynes, 1932; Kuran, 1987, pp. 1852–1853; Leriou, 2015; Leriou, 2016, pp. 55,70–77, 92, 94, 113, 199–200, 204; Lianos, 2012, pp. 153–156; Little, 1949, p. 244, 246; Little, 1950, pp. 6, 13–14; Lovat et al., 2010; Lovat & Hawkes, 2013; McCloskey, 1983, p. 482;
By taking Plato (in *Philebus*), Edgeworth, Aristotle, and Pigou into account, a definition (Leriou, 2016, p. 109) of child well-being is formulated as follows: The well-being of children is a society’s chief end, manifested as the (potential) pleasure that they enjoy, originating from certain economic and non-economic factors that determine this chief end (Fig. 2), with the most important being education that instills in children what kind of persons they ought to be.

Consistent to the above, the definition of child poverty is the following: Child poverty is the deviation from the chief end of a society, expressed as the (potential) sad feelings that children experience, originating from the deprivation of some economic or/and non-economic factors that determine this chief end, with the most important being an education that instills in children what kind of persons they ought to be.

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**Fig. 1** The structure of general, child well-being (This figure was formulated with the information retrieved from the following sources: Leriou (2016, p. 55, 113) & Tasopoulos and Leriou (2014, p. 597))

**Fig. 2** The process of attaining general, child well-being (This figure was formulated with the information retrieved from the following source: Leriou (2016))
3 Methodology

3.1 Instruments and Target Population

The tool used to measure child well-being is the same as that employed in the first round of the research (Leriou et al., 2021), and it is structured on indicators and founded on the theoretical framework (Appendix, Fig. 3). It was implemented among children belonging to three school categories: the 6th grade of elementary school (10–11 years old), the 3rd grade of junior high (13–14 years old), and the 3rd grade of high school (16–17 years old) since children of these levels have a broader perception. The tool incorporates six dimensions (synthetic indicators): the first three (D.1, D.2, and D.3) pertain to economic well-being and the other three (D.4, D.5, D.6) relate to non-economic well-being (Appendix, Fig. 3). Every dimension has specific simple indicators, each of which corresponds to specific questions in the questionnaires that were the survey instruments (Leriou et al., 2021) with which the data were collected.

The simple indicators and their corresponding questions in the survey questionnaire are identical with those of the school year 2018–2019, which concerned the first round of the research (Leriou et al., 2021). The responses to the questionnaires were rated using a similar approach adopted in the first round of the research (Leriou et al., 2021).

3.2 Ethics and Funding

The questionnaires, along with the appropriate permission letters (Gross-Manos et al., 2021) addressed to the parents, were examined by specialists and approved by the Ethics and Conduct Committee of the Panteion University. They were also approved by the Ministry of Education, which issued two licenses for carrying out the anonymous survey in schools: one for primary institutions and one for secondary institutions. The students were informed that filling in the questionnaire was not compulsory but voluntary and that they could withdraw from the process at any given moment they decided to – prior to, during, or even after answering. The research received funding from the Hellenic Foundation for Research and Innovation (HFRI) and the General Secretariat for Research and Technology (GSRT) under grant agreement no. 1926.

3.3 Sample

A multi-stage sampling design was adopted to form the students’ sample similar to the first round of the research (Leriou et al., 2021).

In the fourth round, 1,114 students from 25 public schools and 3 Support Centers (SC) of the organization, “The Smile of the Child”, participated (Appendix, Table 1), with 233 attending the 6th grade of elementary school, 351 in the 3rd grade of junior high, and 530 in the 3rd grade of high school. In total, 495 boys and 585 girls completed the questionnaires, while 34 students did not state their gender.
Depending on what students responded to the question on the employment status of their guardians (Questionnaires in Tables 5 and 8, Appendix 1, Leriou et al. (2021)), it was concluded that 578 children belong to a two-parent family, 373 were from a single-parent family with the mother being in the predominant leading role, and 91 children came from a single-parent family with the father as the leader, while 72 children did not provide any information on this.

To identify group of municipalities that are relatively socio-economically homogeneous, a hierarchical cluster analysis (HCA) was performed on a set of six variables with municipality-level aggregate data obtained from the 2011 census (Leriou et al., 2021).

4 Results

A presentation of the results of the first semester of the school year 2020–2021 is as follows.1

First, on the basis of Synthetic Indicators 1, 3, 4, and 5 (CWGi, CWEi, CWNEi; Leriou et al., 2021), the percentage of children below and above the threshold of being at risk of lacking general economic and non-economic well-being was estimated, in total, per school category, per gender, in every cluster and in all of Attica for the timeframe of the first semester of the school year 2020–2021. In other words, the geographical distribution of children’s well-being in the region of Attica was monitored. The results of the Pearson’s chi-squared test are also included.

Estimations based on wSi,Ni and on the Synthetic Indicator 2 (WDNi,i; Leriou et al., 2021) are included in order to present the percentage of children below and above the threshold of all simple indicators and all dimensions, in every cluster and in total of Attica, for the first semester of school year 2020–2021. In addition, the family structure category and the school category of the children are taken into consideration. The results of the Pearson’s chi-squared test are also included.

The findings of a multiple correspondence analysis (MCA) as well as a principal component analysis (PCA) for the first semester of school year 2020–2021 are also mentioned below.

The results of Composite Indicators 7, 8, 9, 10, 11, and 12 (CWT, WDNi,T, wSi,Ni, CWET, CWNET; Leriou et al., 2021) are presented on the level of Attica, per cluster, for the first semester of school year 2020–2021. Furthermore, the one-way analysis of variance (ANOVA) was applied.

4.1 Geographical Distribution of Children’s Well-being (1st Semester, 2020–2021)

According to Table 2 (Appendix), the percentage of children below the threshold in terms of economic, non-economic, and general well-being by municipality

1 Regarding the methodological approach and the statistical analysis used, kindly refer to Sect. 3, Leriou et al., 2021.
clusters of Attica (Leriou et al., 2021), based on the findings of this analysis, proves that there are statistically significant differences in economic well-being ($\chi^2_{[6, N = 1,114]} = 46.458, p < 0.001$), non-economic well-being ($\chi^2_{[6, N = 1,114]} = 29.877, p < 0.001$), and general well-being ($\chi^2_{[6, N = 1,114]} = 33.432, p < 0.001$). With regard to the first semester of the school year 2020–2021 and all the clusters (Appendix, Table 2), the percentage of the total number of children below the threshold of general well-being amounts to 9.6%, while 14.6% and 11.1% fall below the threshold of economic and non-economic well-being respectively. In particular, concerning general well-being, the highest percentages of the total number of children below the threshold are found in Clusters 3 (17.4%), 4 (11.4%), 2 (7.4%), and 5 (6.1%), while Cluster 7 (0.0%) represents the lowest percentage in successively increasing order (Appendix, Fig. 4). From the examination of the parameter of economic well-being, the percentages below the threshold appear to be higher in Clusters 3 (24.8%), 4 (18.4%), 5 (10.4%), 2 (10.1%) and 1 (8.9%), while Clusters 7 (2.7%) and 6 (3.5%) account for the lowest percentages (Appendix, Fig. 5). By focusing on the factor of non-economic well-being, it was concluded that the highest percentage of children below the threshold is observed in Cluster 3 (19.8%) and the lowest in Cluster 7 (0.0%) (Appendix, Fig. 6).

Furthermore, considering elementary school children, their economic ($\chi^2_{[6, N = 233]} = 27.414, p < 0.001$), non-economic ($\chi^2_{[6, N = 233]} = 24.008, p = 0.001$), and general well-being ($\chi^2_{[6, N = 233]} = 18.554, p = 0.005$) are associated with the municipality cluster (Appendix, Table 2). A significantly notable higher representative number of elementary school children falls below the economic well-being threshold in Cluster 3 (54.2%), as compared with other municipality clusters. Similarly, regarding the non-economic and general well-being, the highest percentages of elementary school children below the threshold are found in Cluster 3 (27.1%) and (31.3%) (Appendix, Table 2).

With regard to junior high school children, the results show that there are statistically significant differences in economic well-being ($\chi^2_{[6, N = 351]} = 17.097, p = 0.009$), non-economic well-being ($\chi^2_{[6, N = 351]} = 16.168, p = 0.013$), and general well-being ($\chi^2_{[6, N = 351]} = 18.039, p = 0.006$). Higher shares of junior high school children are below the thresholds of economic (28.6%), non-economic (25.7%), and general (24.3%) well-being in Cluster 3, as compared with other municipality clusters.

In addition, the economic well-being of boys is associated with municipality cluster ($\chi^2_{[6, N = 495]} = 14.357, p = 0.026$; Appendix, Table 2). A higher share of boys is categorized below the economic well-being threshold in Cluster 3 (22.8%) as compared with other municipality clusters. On the other hand, the non-economic well-being of boys falls into the marginal statistically significant level ($p > 0.05$ & $p < 0.15$; Appendix, Table 2). A higher share of boys is below the non-economic well-being threshold in Cluster 5 (18.9%), as compared with other municipality clusters ($\chi^2_{[6, N = 495]} = 12.241, p = 0.057$; Appendix, Table 2).

The economic ($\chi^2_{[6, N = 585]} = 35.260, p < 0.001$), non-economic ($\chi^2_{[6, N = 585]} = 21.471, p = 0.002$), and general well-being ($\chi^2_{[6, N = 585]} = 39.609, p < 0.001$) of girls are associated with the municipality cluster (Appendix, Table 2). Higher shares of girls are below the thresholds of economic (26.4%), non-economic
(20.7%), and general well-being (21.5%) in Cluster 3 as compared with other municipality clusters (Appendix, Table 2).

Moreover, the results of a Pearson’s chi-squared test within school categories portray that economic ($\chi^2_{[2, N = 1,114]} = 56.509, p < 0.001$) and general well-being ($\chi^2_{[2, N = 1,114]} = 21.275, p < 0.001$) are associated with the school category of the children. More specifically, a comparison of all school categories demonstrates that the highest percentage of children below the threshold of being at the risk of lacking general well-being in Attica is apparent in elementary school category (16.3%), followed by junior high school (10.8%), while the high school level came last (5.8%) (Appendix, Table 2). Therefore, children in the elementary school category in the first semester of the school year 2020–2021, face the worst situation in terms of quality of life. Similarly, elementary schools constitute the highest percentage of children (29.2%) falling below the threshold of being at risk of lacking economic well-being in Attica (Appendix, Table 2).

### 4.2 Children at Risk of Lacking Well-being per Simple Indicator and Dimension (1st Semester, 2020–2021)

As shown in Table 3 (Appendix), the dimension of home conditions (D.1), of economic child well-being, is associated with Attica’s municipality clusters ($\chi^2_{[6, N = 1,113]} = 25.805, p < 0.001$). With regard to D.1, the highest percentage of children below the threshold is found in Cluster 3 (20.7%). In addition, concerning the family structure, the highest percentage of children (18.9%), below the threshold of D.1 ($\chi^2_{[2, N = 1,041]} = 9.752, p = 0.008$) is found in the category of single-parent family with father (Appendix, Table 4). It is notable that each of the Simple Indicators of home conditions, except the Simple Indicator 4, is associated with Attica’s municipality clusters. In particular, the highest percentage of children below the threshold in all municipality clusters (35.0%) is noted in Simple Indicator 4, “Humid or cold house” ($\chi^2_{[6, N = 929]} = 4.292, p = 0.637$). As far as the family structure is concerned, the highest percentage of children (46.3%), below the threshold of Simple Indicator 4, “Humid or cold house” ($\chi^2_{[2, N = 869]} = 9.0417, p = 0.009$), is found in the category of single-parent family with father (Appendix, Table 5). Furthermore, in terms of Simple Indicator 11 – “Housing–has an existing house,” the highest percentage of children (18.8%) below the threshold is observed in Cluster 3 ($\chi^2_{[6, N = 994]} = 19.617, p = 0.003$; Appendix, Table 3). Similarly, students in Cluster 3 account for a higher percentage (14.7%) below the threshold of Simple Indicator 1 – “Supply of electricity or lack thereof”, as compared with other clusters ($\chi^2_{[6, N = 1,028]} = 16.486, p = 0.011$). In addition, according to Simple Indicator 2 – “Heating method,” the highest percentage of children (15.4%) below the threshold is found in Cluster 4 ($\chi^2_{[6, N = 1,083]} = 18.297, p = 0.006$). Moreover, students in Cluster 3 present a higher percentage (9.4%) below the threshold of Simple Indicator 10 – “Existing internet connection,” as compared with other clusters ($\chi^2_{[6, N = 1,074]} = 24.582, p < 0.001$; Appendix, Table 3).

The dimension of nutrition (D.2), of economic child well-being, is associated with Attica’s municipality clusters ($\chi^2_{[6, N = 1,103]} = 14.267, p = 0.027$; Appendix,
With regard to D.2, the highest percentage of children below the threshold is found in Cluster 3 (25.5%) (Appendix, Fig. 7). Moreover, regarding the family structure, the highest percentage of children (26.0%) below the threshold of D.2 ($\chi^2_{[2, N = 1,034]} = 12.566, p = 0.002$) is found in the category of single-parent family with mother (Appendix, Table 6). As far as the school category is concerned, the highest percentage of children (31.3%) below the threshold of D.2 ($\chi^2_{[2, N = 1,034]} = 20.786, p < 0.001$) is observed in the elementary school category (Appendix, Table 7). Furthermore, considering Simple Indicators 7 – “Fresh fruit and vegetables daily” ($\chi^2_{[6, N = 991]} = 12.027, p = 0.061$), 5 – “Three meals a day” ($\chi^2_{[6, N = 971]} = 11.677, p = 0.070$), and 8 – “Milk daily” ($\chi^2_{[6, N = 1,027]} = 11.812, p = 0.066$), the percentages below the threshold appear to be marginally higher in this period in Cluster 3, (25.6%), (24.4%), and (23.1%) respectively (Appendix, Table 3). Similarly, children in Cluster 3 present a higher percentage (18.6%) below the threshold related to Simple Indicator 6 – “At least one meal daily with meat, or chicken, or fish, or pulses/vegetables of equal nutritional value,” as compared with other clusters ($\chi^2_{[6, N = 979]} = 21.264, p = 0.002$; Appendix, Table 3).

Furthermore, the dimension of employment status of parents (D.3), of economic child well-being, is associated with Attica’s municipality clusters ($\chi^2_{[6, N = 1,044]} = 50.871, p < 0.001$). In particular, as far as D.3 is concerned, the percentages below the threshold appear to be higher in this period in Clusters 3 (22.6%), 4 (21.5%), 7 (13.5%), 5 (9.2%), and 2 (8.3%), while Cluster 1 (2.1%) accounts for the lowest percentage (Appendix, Table 3). Regarding the family structure, the highest percentage of children (31.1%) below the threshold of D.3 ($\chi^2_{[2, N = 1,028]} = 43.190, p < 0.001$) is found in the category of single-parent family with father (Appendix, Table 8). Taking into account the school category, the highest percentage of children (23.6%) below the threshold of D.3 ($\chi^2_{[2, N = 1,044]} = 30.920, p < 0.001$) is found in the elementary school category (Appendix, Table 9).

The dimension of constant free healthcare (D.4), of non-economic child well-being, is associated with Attica’s municipality clusters ($\chi^2_{[6, N = 817]} = 16.880, p = 0.010$). The highest percentage of children below the threshold of D.4 (13.9%) is found in Cluster 3, (Appendix, Table 3).

The dimension of education (D.5), of non-economic child well-being, is associated with Attica’s municipality clusters ($\chi^2_{[6, N = 1,110]} = 27.061, p < 0.001$). Based on Dimension 5, the highest percentages of children below the threshold are found in Clusters 2 (46.3%) and 3 (40.9%) and the lowest in Cluster 7 (25.7%). In particular, the highest percentage of children (56.1%) below the threshold in all municipality clusters is observed for Simple Indicator 14 – “Love of animals” ($\chi^2_{[6, N = 1,051]} = 46.011, p < 0.001$). Specifically, with regard to this simple indicator, the highest percentages of children below the threshold are found in Clusters 6 (74.5%) and 2 (66.9%). For Simple Indicator 16 – “What virtues are/which are they” ($\chi^2_{[6, N = 1,064]} = 43.010, p < 0.001$), the percentage of children below the threshold in all municipality clusters amounts to 54.8%. More specifically, with regard to this simple indicator, the percentages below the threshold appear to be higher in this period in Clusters 4 (62.3%) and 3 (61.2%). Regarding Simple Indicator 15 – “Love of nature,” Clusters 2 (59.2%) and 6 (58.0%) present higher percentages below the threshold, as compared with other clusters ($\chi^2_{[6, N = 1,064]} = 30.302, p < 0.001$).
In addition, as far as Simple Indicator 13 – “Love of people” – is concerned, the highest percentage of children (38.7%) below the threshold is found in Cluster 1 ($\chi^2_{[6, N = 1,039]} = 14.271$, $p = 0.027$; Appendix, Table 3). With regard to the school category, the highest share of children (42.5%) below the threshold of D.5 is noted in the high school category ($\chi^2_{[2, N = 1,110]} = 62.600$, $p < 0.001$; Appendix, Table 10).

Moreover, Dimension 6, of non-economic child well-being, is associated with Attica’s municipality clusters ($\chi^2_{[6, N = 1,113]} = 37.929$, $p < 0.001$). Concerning D.6, the highest percentage of children (37.6%) below the threshold is observed in Cluster 1 (Appendix, Table 3). In terms of Simple Indicator 19 – “Playing outdoors,” Cluster 5 presents a larger share (62.5%) below the threshold ($\chi^2_{[6, N = 1,093]} = 41.831$, $p < 0.001$). In addition, students in Cluster 1 account for a higher percentage (36.0%) below the threshold of Simple Indicator 20 – “Vacation,” as compared with other clusters ($\chi^2_{[6, N = 1,099]} = 43.798$, $p < 0.001$). Based on Simple Indicator 18 – “Spare time,” Cluster 1 represents a higher percentage (39.0%) below the threshold ($\chi^2_{[6, N = 1,091]} = 24.904$, $p < 0.001$; Appendix, Table 3).

4.3 Multiple Correspondence Analysis – MCA (1st Semester, 2020–2021)

To further explore the relationships between the groups of students below/above the threshold per simple indicator, a multiple correspondence analysis (MCA) was performed (Appendix, Table 11). The factorial model that was adopted has four main axes that explains 47.6% of the total inertia (the 1st axis explains 22.0% of the inertia, eigenvalue $\lambda_1 = 0.199$; the 2nd – 13.2%, $\lambda_2 = 0.119$; the 3rd – 6.8%, $\lambda_3 = 0.061$; and the 4th – 5.6%, $\lambda_4 = 0.051$). Figure 8 (Appendix) depicts the simple indicator categories with the highest percentage of contribution to the 1st and 2nd axes of the model. All the categories used in the analysis (active and supplementary) are statistically significant according to their v. test calculations.

As shown in Table 11 (Appendix), the set of categories contributing most to the definition of Axis 1 includes all simple indicators of D.2 that are pinpointed below the threshold and to a lesser extent the simple indicators of D.1 (power cut, heating, and internet) that are located below the threshold, as well as the simple indicator of D.3 that is pinpointed below the threshold. Overall, it appears that Axis 1 predominantly reflects the economic well-being of students. The set of categories that most contributes to the definition of Axis 2 comprises the simple indicators of Dimension 5 (love of people, empathy, love of nature and love of animals). This finding indicates that Axis 2 predominantly represents Dimension 5 (Appendix, Table 11). Overall, Axis 1 and Axis 2 essentially confirm the structure of the indicators concerning well-being (economic and non-economic) as it was suggested in this study. Moreover, the aforesaid was confirmed in the previous rounds of the research. Hence, the correctness of the theoretical and methodological framework of this study can be confirmed.

In addition, Axes 3 and 4 reflect underlying patterns of well-being that are more complex (e.g., a combination of non-economic and economic well-being of children; Appendix, Table 11). Specifically, the set of categories contributing most to the definition of Axis 3 include all simple indicators of D.6, the simple indicator
16 of D.5, and to a lesser extent the simple indicator 11 of D.1, which is pinpointed below the threshold.

Finally, the categories that most contribute to the definition of Axis 4 are mainly those related to moral values and social solidarity (D.5.) and, to a lesser extent, the quality of nutrition (D.2; Appendix, Table 11).

Moreover, as shown in Fig. 9 (Appendix), the simple indicators with the largest contribution to child well-being belong to the following dimensions: 5 (moral education) and 2 (nutrition). The aforesaid has also been confirmed in the previous rounds of the research. Hence, this further confirms the correctness of the theoretical and methodological framework of this study.

4.4 Principal Component Analysis – PCA (1st Semester, 2020–2021)

A PCA was performed (Appendix) to confirm the aforementioned results and discover which dimensions contribute to child well-being and which do not. A linear combination of two components of well-being was established. The linear combination of the components shows that the dimensions having the largest contribution to child well-being are as follows (Appendix, Table 12): 5 (moral education) and 2 (nutrition), as they also arose in all the previous rounds of the research (Leriou et al., 2021, 2022a, 2022b). In addition, the aforementioned is confirmed by MCA. Hence, this further confirms the correctness of the theoretical and methodological framework of this study. These are followed by Dimensions 1 (housing conditions), 3 (unemployment), 4 (healthcare), and finally, 6 (spare time).

The scatter plot presented below indicates the clusters recording the best and worst results in well-being according to the linear combination of the components generated from the PCA (Appendix). Figure 10 (Appendix) shows that the best results were found in Clusters 7 and 6, whereas the worst result was observed in Cluster 3. This has been confirmed by the prior analysis of general well-being (Appendix, Table 2) since the clusters with the best and worst well-being concord with the results of the PCA.

4.5 Results of Mean Scores (1st Semester, 2020–2021)

The processing of data based on Composite Indicators 7, 8, 9, 10, 11, and 12 (Leriou et al., 2021) reveals that with regard to the dimensions in all clusters and all of Attica, the most serious problem appears in Dimension 5 pertaining to the non-economic aspect of well-being (Appendix, Table 13). The dimension that follows in all of Attica relates to the economic aspect of well-being, which is Dimension 3 (Appendix, Table 13).

The results of the one-way ANOVA (Appendix, Table 13) show a statistically significant difference F(6, 1,067)=4.166, p<0.001, in the means of the clusters for Simple Indicator 10, F(6, 1,076)=6.239, p<0.001 for Simple Indicator 2, F(6, 1,021)=2.773, p<0.05 for Simple Indicator 1, F(6, 987)=3.312, p<0.05 for Simple Indicator 11, F(6, 972)=3.597, p<0.05 for Simple Indicator 6, F(6, 1,032)=3.281, p<0.05 for Simple Indicator 13, F(6, 1,044)=9.745, p<0.001 for
Simple Indicator 14, \( F(6, 1,057) = 7.989, p < 0.001 \) for Simple Indicator 15, \( F(6, 1,057) = 7.421, p < 0.001 \) for Simple Indicator 16, \( F(6, 1,084) = 3.189, p < 0.05 \) for Simple Indicator 18, \( F(6, 1,086) = 7.310, p < 0.001 \) for Simple Indicator 19, and \( F(6, 1,092) = 7.554, p < 0.001 \) for Simple Indicator 20. Furthermore, statistical significances were found for Dimension 1 – \( F (6, 1,107) = 4.929, p < 0.001 \), Dimension 2 – \( F (6, 1,096) = 3.696, p < 0.05 \), Dimension 3 – \( F (6, 1,037) = 5.779, p < 0.001 \), Dimension 4 – \( F(6, 810) = 2.848, p < 0.05 \), Dimension 5 – \( F (6, 1,103) = 6.282, p < 0.001 \), and Dimension 6 – \( F (6, 1,106) = 10.582, p < 0.001 \). Finally, a statistically significant difference in the means of the clusters was found for economic well-being, \( F (6, 1,107) = 7.263, p < 0.001 \), for non-economic well-being, \( F (6, 1,107) = 7.456, p < 0.001 \), and for general well-being, \( F (6, 1,107) = 8.777, p < 0.001 \) (Appendix, Table 13).

5 Discussion

The processing of data based on Synthetic Indicators 1, 3, 4, and 5 (Appendix, Table 2) shows that for the first semester of school year 2020–2021, the worst situation regarding general child well-being is found in Cluster 3. This is confirmed by a PCA (Appendix, Fig. 10).

In addition, the processing of data pertaining to Synthetic Indicator 2 (Appendix, Tables 3–10) reveals that at the level of dimensions, in the majority of the clusters and the whole of Attica, the gravest problem was observed in Dimension 5 related to the non-economic aspect of well-being (Appendix, Table 3). The dimension that follows in all of Attica pertains to the economic aspect of well-being, which is Dimension 2 (Appendix, Table 3).

Furthermore, the results on the basis of Composite Indicators 7, 8, 9, 10, 11, and 12 (Appendix, Table 13) are confirmed by the findings from the previous rounds of the research (Leriou et al., 2021, 2022a, 2022b).

The 7.3% of children in all of Attica, who are below the threshold in terms of D.4 (Appendix, Table 3), causes surprise as far as the constant access to free health services is concerned, which is higher than the equivalent percentage for the same semester of the last school year, and while in Greece, there is the possibility of everyone having access to free health services. There seems to be a perception among children that access to free health care is not possible, perhaps due to the pandemic that has globally rendered the number of public medical staff and public medical infrastructure insufficient. This situation may reinforce such an impression on children. On the other hand, in their wider family circle, they may have experienced a serious, emergency case that required immediate access to medical services, and perhaps due to the delays that the pandemic may have created for non-COVID-19 cases, might not have been always possible to treat them with increased priority, leading them to use private health services at high costs. All this may cause insecurity in children and give them the impression that they do not have the ability to access free health services at any time needed and respond to this research accordingly.
The percentage of children (62.5%) below the threshold is also high in Cluster 5, which consists mainly of children from island areas, such as Aegina, regarding the Simple Indicator 19 – “Playing outdoors,” (Appendix, Table 3) indicative of non-economic well-being. Children in island areas have more access to the countryside than those in urban centers, so this percentage is surprising at first glance. However, this is a consequence of the pandemic. Although no quarantine or curfew was enforced at the time the children participated in the survey, many of the children in island areas particularly seem to strictly avoid being outdoors in the countryside. So, it seems that in island areas where the economy is mainly dependent on tourism and it cannot recover with a high percentage of COVID-19 cases, children in fact adhere to protection measures very strictly and avoid unnecessary transportations to the countryside, even if there’s no curfew in force. This of course is due to how societies generally behave in island areas where the economy and therefore their survival depend on tourism. It is thus clear people in these areas are reacting much more responsibly to public health protection measures, trying to keep COVID-19 case rate as low as possible to avoid new lockdowns, which cause a downturn in their tourism economy.

Moreover, a crucial finding of PCA is that the dimensions with the greatest contribution to child well-being are D.5 and D.2 (Appendix, Table 12), which is confirmed by MCA (Appendix, Table 11). Consider all the previous rounds of the research (Leriou et al., 2021, 2022a, 2022b), the findings of PCA and MCA are very important.

As shown in Fig. 8 (Appendix), classified on the right side of Axis 1 are students mainly from Cluster 3, who tend to report that they live in jobless households, are nutritionally deprived (Appendix, Fig. 9), reside in homes with multiple problematic conditions, and did not have family vacation in the past year (Appendix, Table 11). This group of students also report that their parents are not able to access free public healthcare services. On the right side of Axis 2 (Appendix, Fig. 8), elementary-school students (Sch. Level 1) are very close to the above-threshold categories of the simple indicators of D.5 – “Empathy,” “Love of people,” “Love of animals,” “Love of nature,” and “Social Solidarity” (Appendix, Fig. 9). On the contrary, on the left side of Axis 2 (Appendix, Fig. 8), high school students (Sch. Level 3) are located very close to the below-threshold categories of the simple indicators of D.5 (Appendix, Table 11) – “Empathy,” “Love of people,” “Love of animals,” “Love of nature,” and “Social Solidarity” (Appendix, Fig. 9). Axis 2 represents the educational system in Greece, where young children are mildly encouraged to cultivate their inner world. Meanwhile, the older children are encouraged to prepare for their final exams.

Furthermore, as shown in Fig. 11 (Appendix), indicated on the right side of Axis 3 are students who have recently gone through periods in their lives with no quality or safe heating methods; they are also deprived of quality time when not in school and in terms of learning of moral values (Appendix, Table 11). Essentially, these children’s profiles reflect harsh living conditions, both economic and non-economic. Indicated on the left side of Axis 3 are students who have spent time away from their family homes, staying as guests in other peoples’ houses or in the public establishments or community homes of “The Smile of the Child”. However, such students
tend to enjoy quality time when not in school, and they have learned about virtues (Appendix, Table 11, and Fig. 11).

Among the sample of children with this profile, some may probably come from the Support Centers for families of “The Smile of the Child”. In this context, they may have previously lived in the community homes of “The Smile of the Child”. And, they may have even participated in the recreational activities conducted by the organization, which focuses on the development of essential humanitarian values, before reuniting with their families. After their reunion, the families were supported by the Support Centers and in some cases, the children benefited from the Day-care Homes of “The Smile of the Child”, which also provide recreational activities. Overall, the left side of Axis 3 reflects the good effect of “The Smile of the Child” for children in need.

On Axis 4 (Appendix, Table 11), an underlying structure of child well-being that links the COVID-19 pandemic to well-being of students can be reflected. Marked on the left side of Axis 4 (Appendix, Fig. 11) are mainly elementary school students (Sch. Level 1) as well as boys, who tend to report that they are deprived in terms of nutrition and in terms of moral values and social solidarity. Perhaps, for these students, access to school meals has been interrupted, in the period when the schools remain closed due to the pandemic. In addition, long-distance learning implemented with more difficulty for elementary school children. In the light of the aforesaid, teachers are putting more emphasis on the development of students’ skills rather than on the development of their social solidarity. On the right side of Axis 4 are mainly high school students (Sch. Level 3) as well as girls who tend to report positively on the contribution of the school to their social solidarity development and remark that they have read about moral values or virtues (Appendix, Fig. 11). However, they report that they live in jobless households and didn’t have family vacation in the past year (Appendix, Table 11). Perhaps, the COVID-19 health crisis affected their well-being in the aspects of unemployment and vacation. However, as high school girls select more humanistic subjects in comparison with the boys, they are informed about social solidarity and moral values.

All these findings indicate the geographical distribution and multi-dimensional characteristics of the deterioration of child well-being in the region of Attica, in the light of the COVID-19 health crisis.

5.1 Suggestions for Action Planning

Taking into account the school categories and clusters, it is observed that 43.5% of elementary-school children in Cluster 3 (Appendix, Table 14) are at risk of lacking well-being in terms of nutrition, while the corresponding percentage for the first half of the school year 2019–2020 was 37.8% (Leriou et al., 2022a; Table 8), followed by the school category of elementary school in Cluster 4 with a percentage of 34.8% (Appendix, Table 14), whereas the corresponding percentage in the same semester of the previous school year was 13.1%, (Leriou et al., 2022a, Table 8). In addition, the results for the corresponding semester of last year revealed problems in the school category of high school, where the practice of providing school meals
was not followed (Leriou et al., 2022a). These differences from the results for the corresponding half of last school year (Leriou et al., 2022a) are a consequence of the current global health crisis caused by COVID-19. It is widely accepted in all scientific and economic circles that almost every crisis tends to make the poor poorer due to the increasing gap between the rich and poor, i.e., the increase in inequality. So, the context under consideration is such a case. In particular, many elementary school children, until recently, were fed with the help of school meals, which would be otherwise difficult due to the general financial difficulties of their environment. However, the fact that many schools have closed because of the pandemic has interrupted this important provision to the children. Therefore, children who are already more vulnerable to poverty are more negatively affected in terms of their well-being than children who did not need school meals to meet their nutritional needs. In the light of the aforesaid, it is important to find solutions to this problem during the periods when the schools remain closed, so that the most vulnerable children won’t have to suffer in terms of lack of well-being. Perhaps appropriate agreements could be made with catering companies so that the meals somehow reach their home every day. Alternatively, the families of these children can be given the opportunity to buy quality, free raw food for cooking. Particular emphasis should be placed on the areas of Attica where, according to Fig. 7 (Appendix), the highest percentages of children fall below the threshold in terms of nutrition is concerned. In any case, this finding, in the fourth round of the research, should not be disregarded due to the seriousness that it entails.

As far as D.5 is concerned, measures that have been proposed in the previous rounds of the research must be implemented (Leriou et al., 2021, 2022a, 2022b). Further, emphasis must be given to high school children (Appendix, Table 10).

Regarding D.3 – “Unemployment”, the highest percentage of children below the threshold appears to be in Cluster 3 (Appendix, Table 3), whereas the overall percentage for all children in Attica amounts to a higher percentage compared with its corresponding percentage for the first semester of the previous year (Leriou et al., 2022a, Appendix, Table 3). Considering the family structure, the largest percentage of unemployment is seen among men who raise their children on their own (Appendix, Table 8). In particular, the percentage of children below the threshold regarding the unemployment of their parents accounts for 31.1% for families with one male parent, followed by families with one female parent with a percentage of 19.5%, and, finally, families with two parents with a percentage of 8.6% (Appendix, Table 8). Therefore, we observe that the children from families with one male parent are more vulnerable to be deprived of their well-being in relation to the unemployment of their parent. Simultaneously, in D.1, which includes living conditions at home (heating, electricity, internet, etc.), the highest percentage of children below the threshold is again seen in families with one male parent (Appendix, Table 4). A characteristic case is Simple Indicator 4 “Humid or cold house” of D.1, where, while it appears to be the worst situation among all other simple indicators of D.1, the highest percentage of children below the threshold in terms of this simple indicator is found in families with one male parent, representing 46.3% (Appendix, Table 5). Unemployment leads to an inability in providing the appropriate material living conditions for children, and failing to maintain a constantly warm home is an outcome
of unemployment. The largest percentage of the unemployed is men who raise their children on their own compared with unemployed women who do the same (Appendix, Table 8). Perhaps, the aforesaid can be justified by the fact that a part of society can possibly demonstrate a larger sensitivity toward single mothers, and, as a result, they receive bigger support during the job finding process. On the other hand, men are prouder concerning their professional life, and they hesitate to ask for help and support from their social surroundings for the fear that they be stigmatized as unable to succeed in their lives; this even applies in a case of emergency such as the current pandemic that has subsequent repercussions on the professional field. So, it is necessary that drastic measures be taken for supporting unemployed men who raise their children on their own, aiming to help them find a job immediately. Certainly, this does not mean that unemployed mothers who also raise children on their own should be deprived of the benefits of these measures. Maybe the association of industries (that are not as negatively influenced by the lockdowns as other professional sectors, e.g., the tourism sector) together with institutions that support families with children could give unemployed single fathers the opportunity for finding a job. From such an affiliation, all parties could be benefited, as the industries would have the opportunity to hire more responsible and productive employees since single fathers have the desire to work for the sake of their children, and this is a very powerful professional motivation.

Cluster 3, as mentioned previously, deals with serious issues regarding the economic subcategory of child well-being. However, the second highest percentage of children below the threshold related to Simple Indicator 18 “Spare time for recreational activities” of Dimension 6 (D.6), representing non-economic child well-being, is again noted in Cluster 3 and amounts to 26.9% (Appendix, Table 3). So, a large percentage of children in this cluster claim that they do not devote their free time to poetry, painting, literature, music, other arts, sports, etc., or spend time with a pet, for instance. This demonstrates the fact that when people struggle for their basic survival, they consider free time for recreational activities insignificant, which is however a crucial factor in influencing their well-being. Furthermore, the greater percentage of children below the threshold according to Simple Indicator 18 “Spare time for recreational activities” of D.6 is seen in Cluster 1 at 39.0% (Appendix, Table 3). So, it is imperative mainly for children in Clusters 3 and 1 that leisure activities are provided by the state as merit goods according to Musgrave (1959). In public finance, merit goods are defined as those goods that should be provided by the state free of charge even if the citizens do not ask for them, as they may not necessarily know what their interest is, such as opera performances. For the children in Clusters 3 and 1, the merit goods could be, for example, free, continuous electronic access to quality theatrical performances, lessons in painting, music, dance, poetry, literature, other arts, etc., and, when the pandemic ends, free-of-charge face-to-face recreational activities. These free benefits could be availed through the services of the municipalities where they belong, or by authorities of the region of Attica.

Therefore, the proposed action plan to improve the well-being of children, which seems to have aggravated significantly, compared with the same half of the last school year, due to the global COVID-19 crisis, includes all the aforesaid. Moreover, due to the seriousness of the current situation, it is also proposed
the establishment of a new Ministry that is primarily aimed at the well-being of children. This ministry will be responsible for measuring and monitoring the well-being of children and implementing action plans to ensure their well-being. Such an initiative would give the children growing up in Greece the opportunity to become more visible in the political sphere and to involve them in public dialogue. Besides, as the aforementioned finding regarding D.2 (nutrition) reveals an increase of inequalities in the Greek society on account of the global COVID-19 crisis, it is recommended that the decision-makers in charge of fiscal policy should aim at reducing inequalities through direct taxation (e.g., Personal Income Tax), and not through indirect taxation (Value Added Tax). Direct taxes are particularly used as an effective tool for the mitigation of income inequalities, while indirect taxes are a burden for the income-inferior classes, thereby aggravating the inequalities. From this point of view, the exclusion of Value Added Tax from all essential goods in child nutrition is suggested as an example. The efforts aimed at mitigating the aggravation of child well-being should be coordinated, and many different institutions dealing with policy should be mobilized, primarily the institutions implementing fiscal policy. The said coordination can be successfully achieved through the establishment of a specific new ministry, which will exclusively be in charge of ensuring child well-being.

5.2 Fuzzy Logic as an Auxiliary Tool for Action Planning

The decision-makers of public policies who aim to implement measures for the improvement of total general child well-being, e.g., in all of Attica, may consider the results pertaining to Composite Indicator 7 for the first semester of the school year 2020–2021 (Appendix, Table 13), having the following form:

\[ \text{CWT} = \left( 0.8467 + 0.8293 + 0.6288 + 0.9266 + 0.4711 + 0.7312 \right) / 6 = 0.7390 \]

Given that the score of perfect well-being is 1, they may set goals for increasing the total well-being in relation to 1 by keeping in mind the well-being scores corresponding to the dimensions. Moreover, if they aim to improve the most contributing dimensions to child well-being, according to PCA and MCA, they can plan measures based on D.2 and D.5.

The rules of a fuzzy inference system are applied as an auxiliary tool for decision-making, similar to that used in the first round of the research (Leriou et al., 2021). This tool can be utilized for monitoring child well-being and policies in the light of the COVID-19 health crisis according to the OECD (2021, pp.10–11).

So, if, according to these rules, the child well-being for the first semester of the school year 2020–2021 is at Ch.W.9. (Leriou et al., 2021), and the decision-makers aim to reach a well-being score of Ch.W.10., there are 26,907 rules from a total of 2,985,984 to meet this objective. To further narrow down this number of rules, they can factor in three criteria that should apply at the same time: a) D.2 and D.5 larger than 0.96; b) the rules in which each entry or each dimension is larger or equal to the average value of all the data; and c) the exit data or outputs are larger or equal to 0.89 and at the same time smaller or equal to 0.9. Thus, they can limit the rules to 8 (Appendix, Table 15).
Let’s suppose that they choose the following rule: R.2,732,955: IF (D.1 = 0.93) AND(D.2 = 0.98) AND(D.3 = 0.76) AND(D.4 = 0.98) AND(D.5 = 0.98) AND(D.6 = 0.76), THEN(CWT = 0.90) (Appendix, Table 15). Based on this rule, to achieve the goal of 0.90 in the following year (i.e., an improvement of total general well-being by 16%), the decision-maker must improve D.1 by 8%, D.2 by 15%, D.3 by 13%, D.4 by 5%, D.5 by 51%, and D.6 by 3%. Therefore, the next step is to develop measures that will drive child well-being towards these arithmetic goals. At the same time, on the basis of Table 13 (Appendix), the decision-maker must be in a position to monitor the results for the following year whether the goal of total general well-being has been met, either fully or partially. Consequently, these rules can be used as an auxiliary tool in any given action plan for the improvement of child well-being.

5.3 Limitations

The C.W.—SMILE research tool is currently used only in Greece. To relate its results with those of tools being used in other countries, a calibration must be performed. In addition, efforts are being made to implement the C.W.—SMILE research tool in other countries, to facilitate a comparison of the results. In view of the foregoing, it may be possible to compare the results of the Greece with those of other countries in the future.

6 Conclusions

This paper presented the results of the fourth round of the research related to the first semester of the school year 2020–2021.

Regarding the main results of the fourth round, the value of the Composite Indicator of the Total General Well-being (CWT) is 0.74, while the percentage of the total number of children in Attica below the threshold of being at the risk of lacking general well-being based on the Synthetic Indicator of Personal General Child Well-being (CWGi) is 9.6%. In addition, all the clusters of Attica present issues with the fact that the education provided in Greece does not focus on what kind of people students ought to be, which was also noted in all the previous rounds of the research (Leriou et al., 2021; Leriou et al., 2022a; Leriou et al., 2022b). This result shows that either relevant measures (Leriou et al., 2021, 2022a) have not been taken for the improvement of child well-being or they have not been successful.

As far as the most crucial findings from this round are concerned, the decision-makers should focus mostly on Public Finances so that child well-being in Attica is enhanced. Regarding nutrition, emphasis should be put on single-parent families with mother and on elementary school children. Further, concerning unemployment, special attention should be given to single-parent families with father. With reference to education, which focuses on what kind of persons children ought to be, emphasis must be given to high school children.
In the light of the above, it is noted that with regard to national policy and legislation framework, the status of welfare state in Greece is ineffective and problematic, so the establishment of a new Ministry regarding the protection of child well-being is a necessity. In order to be effective, this Ministry will have to be staffed exclusively by academics specialized scientifically in child well-being, social (general) welfare, public finance, and welfare economics. In light of the fact that outputs of MCA confirm the positive effect of “The Smile of the Child” for the children in need, this Ministry should consider “The Smile of the Child” as a good practice and a role model.

In conclusion, this paper, through the fourth round of research, revealed the multi-dimensional characteristics, the extent, and the geographical distribution of child well-being in the region of Attica.
| School Category | Sample | Attica municipality clusters | 1  | 2  | 3  | 4  | 5  | 6  | 7  | Total |
|-----------------|--------|-----------------------------|----|----|----|----|----|----|----|-------|
| Elementary      | Schools (SCs) | 1(SC) | 1(SC) | 1 (SCs) | 3(SCs) | 1(SC) | 1  | 1  | 9    |
|                 | Students   | 23    | 16    | 48    | 114   | 17   | 5  | 10 | 233  |
| Junior High     | Schools (SCs) | 1(SC) | 1 (SC) | 1(SC) | 2(SCs) | 1  | 1  | 1  | 8    |
|                 | Students   | 11    | 89    | 70    | 117   | 39   | 10 | 15 | 351  |
| High School     | Schools (SCs) | 1 | 1 | 2(SCs) | 1(SC) | 1 | 1 | 1 | 8    |
|                 | Students   | 67    | 84    | 124   | 85    | 59   | 99 | 12 | 530  |
| Total           | Schools (Total Number of SCs) | 3 | 3 | 4 | 6 | 3 | 3 | 3 | 25(3) |
|                 | Students   | 101   | 189   | 242   | 316   | 115  | 114 | 37 | 1,114 |
Table 2  Percentage of students above or below the threshold of being at risk of lacking economic, non-economic and general well-being by cluster, school level, and gender (1st Semester of School year 2020–2021) (Regarding economic well-being the threshold is set at 60% of the median of the economic well-being indicator (school year reference: 2018–2019; Leriou et al., 2021). Regarding non-economic well-being the threshold is set at 60% of the median of the non-economic well-being indicator (school year reference: 2018–2019) (Leriou et al., 2021). Regarding general well-being the threshold is set at 60% of the median of the total score of synthetic indicators of personal, general well-Being (CWG,; school year reference: 2018–2019; Leriou et al., 2021)

| Clusters                      | 1     | 2     | 3     | 4     | 5     | 6     | 7     | Total |
|-------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Economic Well-being of Children |       |       |       |       |       |       |       |       |
| Below threshold               | 8.911 | 10.053| 24.793| 18.354| 10.435| 3.509 | 2.703 | 14.632|
| Above threshold               | 91.089| 89.947| 75.207| 81.646| 89.565| 96.491| 97.297| 85.368|
* $p$-value $= < 0.001$
| Non-economic Well-being of Children |       |       |       |       |       |       |       |       |
| Below threshold               | 8.911 | 12.169| 19.835| 7.595 | 10.435| 7.018 | 0.000 | 11.131|
| Above threshold               | 91.089| 87.831| 80.165| 92.405| 89.565| 92.982| 100.000| 88.869|
* $p$-value $= < 0.001$
| General Well-being of Children |       |       |       |       |       |       |       |       |
| Below threshold               | 4.950 | 7.407 | 17.355| 11.392| 6.087 | 2.632 | 0.000 | 9.605 |
| Above threshold               | 95.050| 92.593| 82.645| 88.608| 93.913| 97.368| 100.000| 90.395|
* $p$-value $= < 0.001$
| Economic Well-being of Elementary School Children |       |       |       |       |       |       |       |       |
| Below threshold               | 17.391| 6.250 | 54.167| 29.825| 17.647| 0.000 | 0.000 | 29.185|
| Above threshold               | 82.609| 93.750| 45.833| 70.175| 82.353| 100.000| 100.000| 70.815|
* $p$-value $= < 0.001$
| Non-economic Well-being of Elementary School Children |       |       |       |       |       |       |       |       |
| Below threshold               | 4.348 | 12.500| 5.263 | 0.000 | 0.000 | 0.000 | 0.000 | 9.442 |
| Above threshold               | 95.652| 87.500| 94.737| 100.000| 100.000| 100.000| 100.000| 90.558|
* $p$-value $= 0.001$
Table 2 (continued)

| Clusters                                      | General Well-being of Elementary School Children | Economic Well-being of Junior High Children | Non-economic Well-being of Junior High Children | General Well-being of Junior High Children | Economic Well-being of High School Children | Non-economic Well-being of High School Children |
|-----------------------------------------------|--------------------------------------------------|-------------------------------------------|-----------------------------------------------|--------------------------------------------|---------------------------------------------|-----------------------------------------------|
| Below threshold                               | 8.696 0.000 31.250 18.421 0.000 0.000 0.000 16.309 | 9.091 7.865 28.751 13.675 15.385 0.000 0.000 6.667 14.530 | 0.000 14.607 25.714 10.256 10.256 0.000 0.000 13.390 | 9.091 7.865 24.286 8.547 7.692 0.000 0.000 10.826 | 5.970 13.095 11.290 9.412 5.085 4.040 0.000 8.302 | 11.940 9.524 13.710 7.059 13.559 8.081 0.000 10.377 |
| Above threshold                               | 91.304 100.000 68.750 81.579 100.000 100.000 100.000 83.691 | 90.909 92.135 71.429 86.325 84.615 100.000 100.000 85.470 | 90.000 85.393 74.286 89.744 89.744 100.000 100.000 86.610 | 90.909 92.135 75.714 91.453 92.308 100.000 100.000 89.174 | 94.030 86.905 88.710 90.588 94.915 95.960 100.000 91.698 | 88.060 90.476 86.290 92.941 86.441 91.919 100.000 89.623 |

* p-value = 0.005

* p-value = 0.009

* p-value = 0.013

* p-value = 0.006

* p-value = 0.182

* p-value = 0.503
### Table 2 (continued)

| Clusters                      | General Well-being of High School Children | Economic Well-being of Boys | Non-economic Well-being of Boys | General Well-being of Boys | Economic Well-being of Girls | Non-economic Well-being of Girls |
|-------------------------------|------------------------------------------|-----------------------------|---------------------------------|---------------------------|------------------------------|---------------------------------|
| Below threshold               | **2.985** | **8.333** | **8.065** | **5.882** | **6.780** | **3.030** | **0.000** | **5.849** |
| Above threshold               | **97.015** | **91.667** | **91.935** | **94.118** | **93.220** | **96.970** | **100.000** | **94.151** |
| * p-value = 0.505            |            |            |            |            |            |            |            |            |
| Economic Well-being of Boys  | Below threshold | **11.364** | **13.000** | **22.807** | **17.323** | **10.811** | **3.390** | **7.143** | **14.747** |
| Above threshold               | **88.636** | **87.000** | **77.193** | **82.677** | **89.189** | **96.610** | **92.857** | **85.253** |
| * p-value = 0.026            |            |            |            |            |            |            |            |            |
| Non-economic Well-being of Boys | Below threshold | **15.909** | **13.000** | **17.544** | **7.874** | **18.919** | **5.085** | **0.000** | **12.121** |
| Above threshold               | **84.091** | **87.000** | **82.456** | **92.126** | **81.081** | **94.915** | **100.000** | **87.879** |
| * p-value = 0.057            |            |            |            |            |            |            |            |            |
| General Well-being of Boys   | Below threshold | **11.364** | **10.000** | **14.035** | **11.024** | **13.514** | **1.695** | **0.000** | **10.303** |
| Above threshold               | **88.636** | **90.000** | **85.965** | **88.976** | **86.486** | **98.305** | **100.000** | **89.697** |
| * p-value = 0.197            |            |            |            |            |            |            |            |            |
| Economic Well-being of Girls | Below threshold | **5.455** | **6.024** | **26.446** | **19.101** | **11.268** | **3.704** | **0.000** | **14.359** |
| Above threshold               | **94.545** | **93.976** | **73.554** | **80.899** | **88.732** | **96.296** | **100.000** | **85.641** |
| * p-value = <0.001           |            |            |            |            |            |            |            |            |
| Non-economic Well-being of Girls | Below threshold | **3.636** | **10.843** | **20.661** | **7.865** | **7.042** | **9.259** | **0.000** | **10.256** |
| Above threshold               | **96.364** | **89.157** | **79.339** | **92.135** | **92.958** | **90.741** | **100.000** | **89.744** |
| * p-value = 0.002            |            |            |            |            |            |            |            |            |
| Clusters | General Well-being of Girls |
|----------|-----------------------------|
| Below threshold | 0.000 | 3.614 | 21.488 | 12.360 | 2.817 | 3.704 | 0.000 | 9.402 |
| Above threshold | 100.000 | 96.386 | 78.512 | 87.640 | 97.183 | 96.296 | 100.000 | 90.598 |

* p-value = < 0.001
Fig. 4 Geographical distribution of general, child well-being (1st semester of school year 2020–2021) (For more information on the 7 Clusters and their constituent municipalities, kindly refer to the Appendix, Table 16.)

Fig. 5 Geographical distribution of economic, child well-being (1st semester of school year 2020–2021) (For more information on the 7 Clusters and their constituent municipalities, kindly refer to the Appendix, Table 16.)
Fig. 6 Geographical distribution of non-economic, child well-being (1st semester of school year 2020–2021) (For more information on the 7 Clusters and their constituent municipalities, kindly refer to the Appendix, Table 16.)

Fig. 7 Geographical distribution of D.2 (1st semester of school year 2020–2021) (For more information on the 7 Clusters and their constituent municipalities, kindly refer to the Appendix, Table 16.)
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Table 3  Percentage of students at or below the threshold of being at risk of lacking child well-being per simple indicator, per dimension, and per cluster (1st semester of school year 2020–2021)(The calculations are performed using the formula \( w_{S,N} \), based on Synthetic Indicator 2, \( W_{D,N} = \frac{\sum w_{S,N}}{j} \) (Leriou et al., 2021), and Table 3, Appendix (Leriou et al., 2022a). The percentages of students above or below the threshold for variables with two values (“0” or “1”) are equal to the percentages of frequencies for these variables.)

| Dimensions | Simple Indicators                                      | Attica municipality clusters |
|------------|--------------------------------------------------------|------------------------------|
|            |                                                       | 1  | 2  | 3  | 4  | 5  | 6  | 7  | Total | P-value |
| D.1        | 10 (Existing internet connection)                      | 3.125 | 2.210 | 9.442 | 6.977 | 1.770 | 0.877 | 0.000 | 4.935 | < 0.001 |
|            | 4 (Humid or cold house)                                | 41.772 | 31.056 | 31.776 | 36.719 | 35.632 | 37.374 | 36.364 | 34.984 | 0.637 |
|            | 2 (Heating method)                                     | 10.204 | 4.839 | 14.592 | 15.359 | 10.811 | 6.195 | 11.111 | 11.357 | 0.006 |
|            | 1 (Supply of electricity or lack thereof)              | 12.371 | 8.380 | 14.692 | 12.324 | 8.182 | 2.727 | 2.703 | 10.311 | 0.011 |
|            | 11 (Housing–has an existing house)                     | 6.742 | 14.881 | 18.750 | 15.942 | 11.215 | 3.636 | 13.889 | 13.581 | 0.003 |
|            | Total                                                  | 14.851 | 10.053 | 20.661 | 16.508 | 8.696 | 4.386 | 8.108 | 13.836 | < 0.001 |
| D.2        | 5 (Three meals a day)                                  | 19.355 | 16.071 | 23.415 | 17.472 | 15.464 | 11.538 | 5.714 | 17.405 | 0.070 |
|            | 7 (Fresh fruit and vegetables daily)                   | 21.176 | 19.880 | 25.571 | 23.381 | 18.447 | 14.286 | 5.714 | 20.989 | 0.061 |
|            | 8 (Milk daily)                                         | 16.495 | 14.451 | 23.111 | 20.000 | 15.686 | 10.185 | 13.514 | 17.722 | 0.066 |
|            | 6 (At least one meal daily with meat, chicken, fish, or pulses/vegetables of equal nutritional value) | 10.989 | 8.092 | 18.571 | 14.925 | 10.204 | 3.810 | 5.882 | 12.155 | 0.027 |
|            | Total                                                  | 19.000 | 18.717 | 25.523 | 24.116 | 20.870 | 11.404 | 10.811 | 20.943 | 0.027 |
| D.3        | 9 (Unemployment)                                       | 2.128 | 8.287 | 22.624 | 21.453 | 9.174 | 5.310 | 13.514 | 14.368 | < 0.001 |
| D.4        | 3 (Constant free healthcare)                           | 3.896 | 7.432 | 13.939 | 7.373 | 3.614 | 3.061 | 3.448 | 7.344 | 0.010 |
| D.5        | 12 (Empathy for all people)                            | 47.887 | 47.561 | 48.315 | 41.209 | 42.553 | 46.466 | 36.364 | 45.309 | 0.749 |
|            | 13 (Love of people)                                    | 38.710 | 38.068 | 38.393 | 28.094 | 27.885 | 38.532 | 20.588 | 33.782 | 0.027 |
|            | 14 (Love of animals)                                   | 64.516 | 66.854 | 54.867 | 44.000 | 50.000 | 74.545 | 52.941 | 56.137 | < 0.001 |
|            | 15 (Love of nature)                                    | 48.454 | 59.218 | 50.439 | 36.634 | 46.429 | 58.036 | 42.424 | 47.932 | < 0.001 |
|            | 16 (What virtues are/which are they)                   | 44.792 | 59.777 | 61.207 | 62.333 | 44.954 | 32.743 | 51.429 | 54.793 | < 0.001 |
|            | 17 (Social solidarity)                                 | 35.135 | 44.848 | 44.751 | 39.691 | 38.298 | 38.679 | 50.000 | 41.408 | 0.609 |
|            | Total                                                  | 27.723 | 46.277 | 40.909 | 26.984 | 33.913 | 33.333 | 25.714 | 34.685 | < 0.001 |
| Dimensions       | Simple Indicators     | Attica municipality clusters | 1      | 2      | 3      | 4      | 5      | 6      | 7      | Total | P-value |
|------------------|-----------------------|------------------------------|--------|--------|--------|--------|--------|--------|--------|-------|---------|
|                  | D.6                   |                              |        |        |        |        |        |        |        |       |         |
|                  | 18 (Spare time)       |                              | 39.000 | 15.761 | 26.891 | 20.130 | 18.421 | 22.523 | 22.222 | 22.731 | < 0.001 |
|                  | 19 (Playing outdoors) |                              | 57.576 | 45.355 | 58.403 | 41.346 | 62.500 | 33.628 | 33.333 | 48.307 | < 0.001 |
|                  | 20 (Vacation)         |                              | 36.000 | 13.369 | 25.105 | 20.968 | 28.571 | 7.018  | 8.108  | 20.837 | < 0.001 |
|                  | Total                 |                              | 37.624 | 16.489 | 26.860 | 19.620 | 27.826 | 11.404 | 5.405  | 21.833 | < 0.001 |
Table 4  Percentage of students above or below the threshold in terms of D.1, by family structure category (1st semester of the school year 2020–2021) (1: Single-parent family with mother; 2: Single-parent family with father; 3: Two-parent family. The calculations are performed using the formula \( w_{S,N} \), based on Synthetic Indicator 2, \((W_{D_{b,i}} = \left(\sum_{S} w_{S,N} / j\right))\) (Leriou et al., 2021), and Table 3, Appendix (Leriou et al., 2022a)

| Categories of the Family Structure | 1  | 2  | 3  | Total |
|-----------------------------------|----|----|----|-------|
| Below threshold                   | 16.354 | 18.889 | 10.381 | 13.256 |
| Above threshold                   | 83.646 | 81.111 | 89.619 | 86.744 |

* \( p\)-value = 0.008

Table 5  Percentage of students the threshold in S.1.4, by family structure category (1st semester of the school year 2020–2021) (1: Single-parent family with mother; 2: Single-parent family with father; 3: Two-parent family. The calculations are performed using the formula \( w_{S,N} \) (Leriou et al., 2021, Sect. 3.5) and based on Table 3, Appendix (Leriou et al., 2022a)

| Categories of the Family Structure | 4  | 1  | 2  | 3  | Total |
|-----------------------------------|----|----|----|----|-------|
| Below threshold                   | 37.217 | 46.341 | 30.544 | 34.407 |
| Above threshold                   | 62.783 | 53.659 | 69.456 | 65.593 |

* \( p\)-value = 0.009

Table 6  Percentage of students above or below the threshold in terms of D.2, per family structure category (1st semester of the school year 2020–2021) (1: Single-parent family with mother; 2: Single-parent family with father; 3: Two-parent family. The calculations are performed using the formula \( w_{S,N} \), based on Synthetic Indicator 2, \((W_{D_{b,i}} = \left(\sum_{S} w_{S,N} / j\right))\) (Leriou et al., 2021), and Table 3, Appendix (Leriou et al., 2022a)

| Categories of the Family Structure | 1  | 2  | 3  | Total |
|-----------------------------------|----|----|----|-------|
| Below threshold                   | 26.016 | 20.000 | 16.522 | 20.213 |
| Above threshold                   | 73.984 | 80.000 | 83.478 | 79.787 |

* \( p\)-value = 0.002

Table 7  Percentage of students above or below the threshold in terms of D.2, based on school category (1st semester of the school year 2020–2021) (1: Elementary School; 2: Junior High School; 3: High School. The calculations are performed using the formula \( w_{S,N} \), based on Synthetic Indicator 2, \((W_{D_{b,i}} = \left(\sum_{S} w_{S,N} / j\right))\) (Leriou et al., 2021), and Table 3, Appendix (Leriou et al., 2022a)

| School Categories | 1  | 2  | 3  | Total |
|-------------------|----|----|----|-------|
| Below threshold   | 31.140 | 21.098 | 16.446 | 20.943 |
| Above threshold   | 68.860 | 78.902 | 83.554 | 79.057 |

* \( p\)-value = < 0.001
Table 8 Percentage of students above or below the threshold in terms of D.3, according to family structure category (1st semester of the school year 2020–2021) (1: Single-parent family with mother; 2: Single-parent family with father; 3: Two-parent family. The calculations are performed using the formula \( w_{S,N_i,1} \), based on Synthetic Indicator 2, \( W_{D_{N,i}} = \left( \frac{w_{S,N_i,1} + \cdots + w_{S,N_i,j}}{j} \right) \) (Leriou et al., 2021), and Table 3, Appendix (Leriou et al., 2022a)

| Categories of the Family Structure | 1  | 2  | 3  | Total |
|-----------------------------------|----|----|----|-------|
| Below threshold                   | 19.459 | 31.111 | 8.627 | 14.494 |
| Above threshold                   | 80.541 | 68.889 | 91.373 | 85.506 |

* p-value = < 0.001

Table 9 Percentage of students above or below the threshold in terms of D.3, by school category (1st semester of the school year 2020–2021) (1: Elementary School; 2: Junior High School; 3: High School. The calculations are performed using the formula \( w_{S,N_i} \), based on Synthetic Indicator 2, \( W_{D_{N,i}} = \left( \frac{w_{S,N_i,1} + \cdots + w_{S,N_i,j}}{j} \right) \) (Leriou et al., 2021), and Table 3, Appendix (Leriou et al., 2022a)

| School Categories | 1  | 2  | 3  | Total |
|-------------------|----|----|----|-------|
| Below threshold   | 23.645 | 17.629 | 8.594 | 14.368 |
| Above threshold   | 76.355 | 82.371 | 91.406 | 85.632 |

* p-value = < 0.001

Table 10 Percentage of students above or below the threshold in terms of D.5, by school category (1st semester of the school year 2020–2021) (1: Elementary School; 2: Junior High School; 3: High School. The calculations are performed using the formula \( w_{S,N_i} \), based on Synthetic Indicator 2, \( W_{D_{N,i}} = \left( \frac{w_{S,N_i,1} + \cdots + w_{S,N_i,j}}{j} \right) \) (Leriou et al., 2021), and Table 3, Appendix (Leriou et al., 2022a)

| School Categories | 1  | 2  | 3  | Total |
|-------------------|----|----|----|-------|
| Below threshold   | 13.043 | 37.143 | 42.453 | 34.685 |
| Above threshold   | 86.957 | 62.857 | 57.547 | 65.315 |

* p-value = < 0.001
Table 11  Categories of each simple indicator (+ = above threshold, − = equal or below threshold) with the highest contribution to each factorial axis (1st semester of school year 2020–2021)

| Dimensions | Simple Indicators                  | Factorial Axes |        |        |        |        |
|------------|-----------------------------------|----------------|-------|-------|-------|-------|
|            |                                   | 1              | 2     | 3     | 4     |       |
| D.1        | 10 (Internet)                     |                |       |       |       |       |
|            |                                   |                | Category | %   | Category | %   | Category | %   | Category | %   |
|            |                                   |                |        | 5.597 |        | -      | 3.950 | - 5.933 | 3.892 |          |
|            | 4 (Cold/humid house)              |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
|            | 2 (Heating)                       |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
|            | 1 (Power cut)                     |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
|            | 11 (Homelessness/guest)           |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
| D.2        | 5 (Three meals a day)             |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
|            | 7 (Fruits and vegetables)         |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
|            | 8 (Milk)                          |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
|            | 6 (Meat, fish, pulses)            |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
| D.3        | 9 (Unemployment)                  |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
| D.4        | 3 (Free healthcare)               |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
| D.5        | 12 (Empathy for all people)       |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
|            | 13 (Love of people)               |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
|            | 14 (Love of animals)              |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
|            | 15 (Love of nature)               |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
|            | 16 (Moral values/virtues)         |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
|            | 17 (Social solidarity)            |                |        |       |        |        |       |        |
|            |                                   |                |        |       |        |        |       |        |
Table 11 (continued)

| Dimensions  | Simple Indicators | Factorial Axes |
|-------------|-------------------|----------------|
| D.6         |                   | 1   | 2   | 3   | 4   |
| 18 (Spare time) | - 21.414         | + 6.313 |
| 19 (Playing outdoors) | - 13.415         | + 12.559 |
| 20 (Vacation) | - 5.236          | - 9.478    | - 3.672  |
Fig. 8 Contribution of Variable Categories (2 = above threshold, 1 = equal or below threshold) (1st semester of school year 2020–2021) (The categories of active variables are colored by their contribution values to the definition of each axis. Supplementary variable categories do not contribute to the construction of the axes. Gender 1 = Boys, Gender 2 = Girls; Sch. Level 1 = Elementary School, Sch. Level 2 = Junior High School, and Sch. Level 3 = High School)
Principal Component Analysis

A PCA was performed for the first semester of the school year 2020–2021. The correlation of each of the dimensions and the linear combination of the components are displayed in Table 12. It is observed that the first five dimensions have a strong positive correlation to the well-being indicators and their Pearson correlation coefficient, is statistically significant, different than zero. In addition, the sixth dimension has a positive correlation to the well-being indicators and its Pearson correlation coefficient, is statistically significant, different than zero. Therefore, the PCA demonstrates a close connection to all the six dimensions of well-being adopted in this study.
Table 12  Pearson’s correlations coefficient between the two components and the six dimensions (N = 786. **. Correlations are significant at the 0.01 level. *. Correlation is significant at the 0.05 level (two-tailed)

| Dimensions | Component 1 | Component 2 |
|------------|-------------|-------------|
| D.1        | 0.755**     | -0.125**    |
| D.2        | 0.779**     | -0.067      |
| D.3        | 0.643**     | -0.197**    |
| D.4        | 0.579**     | 0.271**     |
| D.5        | 0.082*      | 0.948**     |
| D.6        | 0.410**     | 0.075*      |

Fig. 10  Clusters by the best and worst well-being
Table 13  Mean score per dimension, indicator, and per cluster (1st semester of the school year 2020–2021) (The calculations are based on Composite Indicators 7, 8, 9, 10, 11, and 12 (CWT, $W_{D,T}$, $w_{S,N}$, CWET, and CWNET) (Leriou et al., 2021). The value of Composite Indicator 6 is equal to the value of Composite Indicator 7 when all values are present (Leriou et al., 2021). However, since there are missing values and the answers “I can’t remember,” “I don’t know,” and “I don’t want to answer” are considered off-scale items, there is a slight discrepancy in the values of Composite Indicators 6 and 7. Specifically, the value of Composite Indicator 6 is equal to 0.7235 (0.7), while the value of Composite Indicator 7 is equal to 0.7390 (0.7). Of course, this does not affect the value of Composite Indicator 12, which is always equal the value of Composite Indicator 7. For the same reasons, the values in the column of the total of Attica are not always exactly the same as the corresponding values of the averages of the seven clusters.)

| Dimensions | Simple Indicators | Clusters | Attica | p-value |
|------------|-------------------|----------|--------|---------|
| D.1        |                   | 1  2  3  4  5  6  7 Total |        |         |
|            | 10 (Existing internet connection) | 0.9688 0.9779 0.9056 0.9302 0.9823 0.9912 1.0000 0.9507 | <0.001 |
|            | 4 (Cold or humid house)          | 0.5823 0.6894 0.6822 0.6328 0.6437 0.6263 0.6364 0.6502 | 0.639  |
|            | 2 (Heating method)               | 0.8691 0.9356 0.8243 0.8387 0.8651 0.9394 0.9366 0.8715 | <0.001 |
|            | 1 (Supply of electricity or lack thereof) | 0.8763 0.9162 0.8531 0.8768 0.9182 0.9727 0.9730 0.8969 | 0.011  |
|            | 11 (Housing–has an existing house) | 0.9326 0.8512 0.8125 0.8406 0.8879 0.9636 0.8611 0.8642 | 0.003  |
|            | Total                          | 0.8458 0.8741 0.8155 0.8238 0.8594 0.8987 0.8814 0.8467 | <0.001 |
| D.2        |                   | 1  2  3  4  5  6  7 Total |        |         |
|            | 5 (Three meals a day)            | 0.8065 0.8393 0.7659 0.8253 0.8454 0.8846 0.9429 0.8260 | 0.069  |
|            | 7 (Fresh fruits and vegetables daily) | 0.7882 0.8012 0.7443 0.7662 0.8155 0.8571 0.9429 0.7901 | 0.061  |
|            | 8 (Milk daily)                  | 0.8351 0.8555 0.7689 0.8000 0.8431 0.8981 0.8649 0.8228 | 0.066  |
|            | 6 (At least one meal daily with meat, chicken, fish, or pulses/vegetables of equal nutritional value) | 0.8901 0.9191 0.8143 0.8507 0.8980 0.9619 0.9412 0.8784 | 0.002  |
|            | Total                          | 0.8300 0.8538 0.7733 0.8106 0.8505 0.9005 0.9229 0.8293 | 0.001  |
| D.3        |                   | 1  2  3  4  5  6  7 Total |        |         |
|            | 9 (Unemployment)                | 0.7234 0.6740 0.5566 0.5761 0.6881 0.6947 0.6351 0.6288 | <0.001 |
| D.4        |                   | 1  2  3  4  5  6  7 Total |        |         |
|            | 3 (Capability to access free healthcare) | 0.9610 0.9257 0.8606 0.9263 0.9639 0.9694 0.9655 0.9266 | 0.009  |
Table 13 (continued)

| Dimensions | Simple Indicators | Clusters | Attica |
|------------|-------------------|----------|--------|
|            |                   | 1  2   3  4  5  6  7  | Total p-value |
| D.5        |                   |         |        |
| 12 (Empathy for all people) | 0.3775 | 0.3652 | 0.3618 | 0.4198 | 0.4064 | 0.4051 | 0.4955 | 0.3910 | 0.493 |
| 13 (Love of people) | 0.5505 | 0.5006 | 0.5277 | 0.6334 | 0.5702 | 0.5376 | 0.6824 | 0.5659 | 0.003 |
| 14 (Love of animals) | 0.3172 | 0.2607 | 0.3969 | 0.4893 | 0.3736 | 0.1991 | 0.4235 | 0.3709 | <0.001 |
| 15 (Love of nature) | 0.4711 | 0.3369 | 0.4364 | 0.5789 | 0.4571 | 0.3670 | 0.5182 | 0.4608 | <0.001 |
| 16 (What virtues are/which are they) | 0.5521 | 0.4022 | 0.3879 | 0.3767 | 0.5505 | 0.6726 | 0.4857 | 0.4521 | <0.001 |
| 17 (Social solidarity) | 0.6486 | 0.5515 | 0.5525 | 0.6031 | 0.6170 | 0.6132 | 0.5000 | 0.5859 | 0.611 |
| **Total** |                   | 0.4862 | 0.4029 | 0.4439 | 0.5169 | 0.4958 | 0.4657 | 0.5175 | 0.4711 | <0.001 |
| D.6        |                   |         |        |
| 18 (Spare time) | 0.6578 | 0.8005 | 0.7080 | 0.7588 | 0.7875 | 0.7428 | 0.7758 | 0.7474 | 0.004 |
| 19 (Playing outdoors) | 0.5960 | 0.6967 | 0.5588 | 0.6987 | 0.5580 | 0.7788 | 0.7639 | 0.6546 | <0.001 |
| 20 (Vacation) | 0.6400 | 0.8663 | 0.7490 | 0.7903 | 0.7143 | 0.9298 | 0.9189 | 0.7916 | <0.001 |
| **Total** |                   | 0.6313 | 0.7879 | 0.6719 | 0.7493 | 0.6866 | 0.8171 | 0.8195 | 0.7312 | <0.001 |
| Economic well-being | 0.7997 | 0.8006 | 0.7151 | 0.7368 | 0.7993 | 0.8313 | 0.8132 | 0.7683 | <0.001 |
| Non-economic well-being | 0.6928 | 0.7055 | 0.6588 | 0.7308 | 0.7154 | 0.7508 | 0.7675 | 0.7096 | <0.001 |
| General well-being | 0.7463 | 0.7530 | 0.6870 | 0.7338 | 0.7574 | 0.7910 | 0.7903 | 0.7390 | <0.001 |
Fig. 11 The most important (or contributing) variable categories to 3rd and 4th axes – MCA
Table 14  Percentage of students on the threshold and below in D.2, per school category and per cluster (1st semester of school year 2020–2021) (1: Elementary School; 2: Junior High School; 3: High School)

| Clusters | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total |
|----------|---|---|---|---|---|---|---|-------|
| Sch. Cat-|   |   |   |   |   |   |   |       |
| egory    |   |   |   |   |   |   |   |       |
| D.2      |   |   |   |   |   |   |   |       |
| Below    | 22.727 | 18.182 | 17.910 | 12.500 | 15.909 | 22.892 | 43.478 | 28.986 | 16.935 | 34.821 | 25.641 | 16.949 | 0.000 | 0.000 | 13.131 | 10.000 | 13.333 | 8.333 | 20.943 |
| thresh-  | old |   |   |   |   |   |   |       | 77.273 | 81.818 | 82.090 | 87.500 | 84.091 | 77.108 | 56.522 | 71.014 | 83.065 | 65.179 | 78.070 | 76.471 | 74.359 | 83.051 | 100.000 | 100.000 | 86.849 | 90.000 | 86.667 | 91.667 | 79.057 |
| Above    |   |   |   |   |   |   |   |       | 77.273 | 81.818 | 82.090 | 87.500 | 84.091 | 77.108 | 56.522 | 71.014 | 83.065 | 65.179 | 78.070 | 76.471 | 74.359 | 83.051 | 100.000 | 100.000 | 86.849 | 90.000 | 86.667 | 91.667 | 79.057 |

*p-value = < 0.001*
### Table 15  The 8 fuzzy inference rules

| Rule Number | Fuzzy Inference Rule |
|-------------|----------------------|
| R.2,482,254 | IF (D.1 = 0.86) AND (D.2 = 0.98) AND (D.3 = 0.66) AND (D.4 = 0.93) AND (D.5 = 0.98) AND (D.6 = 0.98) THEN (CWT = 0.90) |
| R.2,482,397 | IF (D.1 = 0.86) AND (D.2 = 0.98) AND (D.3 = 0.66) AND (D.4 = 0.98) AND (D.5 = 0.98) AND (D.6 = 0.93) THEN (CWT = 0.90) |
| R.2,483,980 | IF (D.1 = 0.86) AND (D.2 = 0.98) AND (D.3 = 0.76) AND (D.4 = 0.93) AND (D.5 = 0.98) AND (D.6 = 0.86) THEN (CWT = 0.89) |
| R.2,485,707 | IF (D.1 = 0.86) AND (D.2 = 0.98) AND (D.3 = 0.86) AND (D.4 = 0.93) AND (D.5 = 0.98) AND (D.6 = 0.76) THEN (CWT = 0.89) |
| R.2,731,228 | IF (D.1 = 0.93) AND (D.2 = 0.98) AND (D.3 = 0.66) AND (D.4 = 0.98) AND (D.5 = 0.98) AND (D.6 = 0.86) THEN (CWT = 0.90) |
| R.2,732,955 | IF (D.1 = 0.93) AND (D.2 = 0.98) AND (D.3 = 0.76) AND (D.4 = 0.98) AND (D.5 = 0.98) AND (D.6 = 0.76) THEN (CWT = 0.90) |

### Table 16  The 7 Clusters and their constituent municipalities of Attica (This table was developed with the information retrieved from the following source: Leriou et al., 2021. This clustering was presented for the first time by Kollias, A., Anastasopoulou, A., Mpitimitiris, G. and Papadopoulos, O. (2018) in the paper, “A spatial analysis of unemployed youths’ vocational profiles in Attica, Greece” at the 11th International Conference of the Hellenic Geographical Society (ICHGS—2018).)

| Municipality                  | Cluster |
|-------------------------------|---------|
| Agia Varvara                 | 1       |
| Aspropyrgos                   | 1       |
| Megara                        | 1       |
| Perama                        | 1       |
| Salamis Island                | 1       |
| Fyli                          | 1       |
| Agia Paraskevi               | 2       |
| Alimos                        | 2       |
| Marousi                       | 2       |
| Vrilissia                     | 2       |
| Glyfada                       | 2       |
| Lykovrysi-Pefki               | 2       |
| Nea Smyrni                    | 2       |
| Palaio Faliro                 | 2       |
| Penteli                       | 2       |
| Rafina-Pikermi                | 2       |
| Halandri                      | 2       |
| Agios Dimitrios               | 3       |
| Agioi Anargyroi-Kamatero      | 3       |
| Agistri                       | 3       |
| Aigaleo                       | 3       |
| Acharnes                      | 3       |
| Galatsi                       | 3       |
| Dafni-Ymittos                 | 3       |
| Municipality                        | Cluster |
|-----------------------------------|---------|
| Eleusis                           | 3       |
| Ilion                             | 3       |
| Kallithea                         | 3       |
| Keratsini-Drapetsona              | 3       |
| Korydallos                        | 3       |
| Kropia                            | 3       |
| Mandra-Eidyllia                   | 3       |
| Metamorfosi                       | 3       |
| Moschato-Tavros                   | 3       |
| Nea Ionia                         | 3       |
| Nikaia-Agios Ioannis Rentis       | 3       |
| Piraeus                           | 3       |
| Peristeri                         | 3       |
| Petroupoli                        | 3       |
| Spata-Artemida                    | 3       |
| Troizinia-Methana                 | 3       |
| Filadelfeia-Chalkidona            | 3       |
| Haidari                           | 3       |
| Athens                            | 4       |
| Vyronas                           | 4       |
| Elliniko-Argyroupoli              | 4       |
| Zografou                          | 4       |
| Ilioupoli                         | 4       |
| Irakleio                          | 4       |
| Kaisariani                        | 4       |
| Kythira                           | 4       |
| Marathon                          | 4       |
| Markopoulo Mesogaias              | 4       |
| Paiania                           | 4       |
| Pallini                           | 4       |
| Poros                             | 4       |
| Saronikos                         | 4       |
| Oropos                            | 4       |
| Aegina                            | 5       |
| Lavreotiki                        | 5       |
| Spetses                           | 5       |
| Hydra                             | 5       |
| Vari-Voula-Vouliagmeni            | 6       |
| Dionysos                          | 6       |
| Papagou-Cholargos                 | 6       |
| Kifissia                          | 7       |
| Filothei-Psychiko                 | 7       |
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Declarations

Ethics Approval  This study obtained ethical approval from the Ethics and Conduct Committee of Panteion University of Social and Political Sciences. In addition, this study obtained licenses from the Ministry of Education. More information: Sect. 3.2.

Consent to Participate.  Parental consent was obtained for all participants. More information: Sect. 3.2.

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