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Pre-Service Teachers' Beliefs on Human Population Growth in the Context of Education for Sustainable Development: Development and Validation of an Instrument

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Abstract

The ongoing debates about the effects of human population growth (HPG) is one of the concepts in education for sustainable development (ESD). Beliefs toward HPG are an important construct for teacher education because beliefs potentially interfere with their instructional practices and students' beliefs, attitudes and behaviors. Accordingly, this study focused on developing and validating an instrument to explore pre-service teachers' beliefs toward the effects of HPG. The instrument was piloted, revised, and the main study was administered to 658 pre-service teachers. The instrument revealed five dimensions: requirements to support HPG; neo-Malthusian environmentalism; population and national economy; quality of human life; and population, resources and environment. Pre-service teachers' beliefs revealed that they needed additional support to understand multiple and nested interactions among HPG, urbanization, energy demand and national economy within the context of sustainability. This instrument is a promising tool to provide insights when designing courses on ESD for pre-service teachers.

Key words: human population growth, teacher education, belief, sustainable development, education for sustainable development

Introduction

Starting from the Brundtland Report (World Commission on Environment and Development, 1987) to the 2030 Agenda for Sustainable Development (2015), the theoretical framework of sustainable development (SD) gradually evolved to endorse human development and the well-being of the planet. After a while, the concept of Education for Sustainable Development (ESD) was included in the SD agenda in Agenda 21

(UNCED, 1992) aimed to promote education and public awareness to make generations meet the solutions for the problems of the present and future. Accordingly, the United Nations as well as governments have been constructing education policies and curriculum frameworks (Stevenson et al., 2015) to achieve Sustainable Development Goals (UN, 2015). Concomitantly, training teachers for ESD has gained prominence and UNESCO put equal emphasis on the need to revise teacher education policies in the context of sustainability (UNESCO, 2005).

Despite efforts to integrate ESD into educational systems, these education policies and curricular frameworks have not been reflected fully in schools (Jickling & Wals, 2012). Steele (2010) suggested that the reason might be the ESD policies and frameworks that had not been integrated fully into pre-service and in-service teacher education programs. Correspondingly, teachers had limited background knowledge on fundamental environmental and sustainability issues (Burmeister & Eilks, 2013; Steele, 2010; UNESCO, 2005). Among these issues, we chose human population growth (HPG), one of the fundamental sustainability issues, as a context of this study for two reasons. First, the outcomes of Agenda 21 and other major United Nations conferences (e.g., UNFPA 1994, 2004) and summits (e.g., UN, 2012, 2015) were converged on the notion that HPG issues and SD framework should be considered as a whole and ESD had inherently an important role for integrating these concepts. Second, HPG is rarely included among the sustainability issues reflected in curricula because HPG (1) embodies contrasting values; (2) is not fully grasped due to its complexity; (3) is a controversial issue in some cultures for religious reasons (Alkahrer & Carmi, 2019).

A Brief Summary on the Trends and Debates in HPG

HPG through the history follows an exponential growth trend. It took thousands of years for the Earth's population to reach one billion by the 18th century (UNFPA, 2017) but only in the last 200 years, it increased sharply and reached nearly 7.9 billion (UNFPA, 2021). The United Nations (UNDESA, 2017) has predicted a global population of almost 9.8 billion people by 2050.

The arguments and conceptions about the effects of HPG have been evolving over time. While the early arguments were about a concern over limits to growth (e.g., Malthus, 1798; Engels, 1844; Meadows et al., 1972), these evolved as a dimension of population–environment–development in the 1980s (e.g., World Commission on Environment and Development, 1987), especially within several UN policy documents. In line with the first pronunciation of sustainable development, HPG related issues were perceived and reframed within a multifaceted context centered on the dimensions of HPG–QHL–quality of environment (e.g., UNCED, 1992; Maja & Ayano 2021). For example, the UN's Agenda 21 (1992) noted that since HPG could put pressure on a country's capability to: manage its economic, social, and environmental issues; address human needs; and ensure sustainability, the planet's carrying capacity should be understood in depth.

Role of Teachers' Beliefs in Sustainability Issues

Preparing teachers for ESD is critical for creating a sustainable future (UNESCO-UNEP, 1990), enabling them to acquire the necessary knowledge, skills, and dispositions needed to understand and deal with the 21st century challenges (UNESCO, 2017). Accord-

dingly, as UNESCO (2005) emphasized, national teacher education policies of sustainability need to be revised to increase pre-service teachers' (PSTs) understanding of multifaceted and transdisciplinary sustainability concepts (Summers et al., 2003; Hepper, 2021; Salite et al., 2021), their attitudes (Tomas et al., 2017; Echegoyen-Sanz & Martín-Ezpeleta, 2021), competencies (Sleurs, 2008; Suleimenova & Ivanova, 2018; Kohl & Hopkins, 2020), beliefs (Yang et al., 2010) and other related dispositions. Among these constructs, several studies reported that beliefs had the potential to interfere with PSTs' teaching and learning (Keys & Bryan 2001), attitudes (Cotton et al., 2007), and behaviors (Corraliza & Berenguer, 2000). Further, teachers' beliefs may affect their instructional plans and decisions (Pajares, 1992; Richardson, 1996), and, subsequently, have ripple effects on students' beliefs, attitudes, and behaviors (Nespor, 1987; Bloom & Ellis, 2009). Considering the above-mentioned, we chose to examine PSTs' beliefs because it may provide important insights into how to revise and improve teacher training programs and teaching practices (Brickhouse & Bodner, 1992; Cronin-Jones, 1991).

We used Fishbein and Ajzen's (1975) belief system as the framework for this study. According to the belief system, a *belief* is a depiction of information which individuals have about an object or a concept, and which connects this object to a specific attribute that may or may not be true. They classified different beliefs on the basis of how they are formed or shaped: 1) direct experiences (descriptive beliefs); 2) derived from direct experiences (inferential beliefs); and 3) derived from outside sources such as media, lecturers, or colleagues (informational beliefs).

Literature Review

Studies on beliefs in environmental education (EE) and ESD may be classified as beliefs about: (a) the natural world (e.g., Price et al., 2014); (b) the nature and extent of human and non-human impacts on the environment (e.g., Dunlap et al., 2000; Lind et al., 2015); (c) controversial environmental issues (e.g., Cotton, 2006; Nation & Feldman, 2021); (d) solutions to environmental problems and sustainability issues (e.g., Arora-Jonsson, 2017; Hess & Maki, 2019). These studies highlighted the importance of beliefs in EE and ESD since each can have very different kinds of effects on curriculum considerations such as goals and objectives (Cotton, 2006; Cronin-Jones, 1991), instructional plans and actual teaching practices (Boon, 2011; Nation & Feldman, 2021). On the other hand, in the existing teacher education literature, several researchers emphasized that few studies have investigated teachers' beliefs in EE (Pooley & O'Connor, 2000; Cotton, 2006) and ESD contexts (Boon, 2011) when compared to the volume of research on other constructs such as knowledge, skills, attitudes and other dispositions.

Although there is ample literature on HPG in different disciplines (e.g., Bell & Odom, 2013; Johnson & Nurick, 1995; Marx, 1890), few studies have examined individual perspectives on HPG (e.g., Alkahr & Carmi, 2019; Holl et al., 1999; Reeder et al., 1974). In a recent study, Alkahr and Carmi (2019) examined teachers' perceptions of HPG and attitudes towards integrating HPG into their teaching practices. The findings indicated that environmental educators perceived HPG as an environmental problem ($p = .001$) compared to non-environmental ones. Moreover, 67% of environmental educators had positive attitudes towards integrating HPG into teaching, while 44% of the non-environmental educators did not. The interview responses revealed the probable reasons for positive attitudes: (1) increasing knowledge and awareness about the effects

of HPG; (2) finding solutions to environmental problems; (3) promoting pro-environmental behavior. The reasons for not integrating HPG were as follows: (1) being irrelevant to learners' daily life; (2) having a controversial nature; (3) not posing a problem; and (4) lack of understanding and teaching skills to teach. Based on the findings, the researchers suggested that teachers' understandings and skills should be promoted to integrate HPG into their teaching practices and highlighted that further studies would be needed to unveil teachers' perceptions, attitudes, concerns, and challenges related to HPG and its multidimensional effects.

Based on this research gap and the ongoing needs to reorient teacher education programs, we believe identifying PSTs' beliefs is essential for developing an understanding of how teachers view contentious environmental and sustainability issues, and the place or role of HPG in that context. Correspondingly, we intended to explore PSTs' beliefs on the effects of HPG to find key routes to embed HPG and carrying capacity concepts into ESD and teacher education programs. As no specific instrument had previously been devised, this study aimed to develop an instrument to explore HPG beliefs in the ESD context and contribute to the field by encouraging the integration of both HPG and HPG-related sustainability issues into teacher education. This instrument could also be used by teacher educators to analyze PSTs' differing beliefs on the effects of HPG. In the long term, the findings collected from this instrument could guide teacher educators, policymakers, and curriculum designers about how to integrate contentious nature of HPG into ESD programs. With this in mind, the research questions were as follows:

- (1) What should the dimensions of a BEHPG (Beliefs on the Effects of Human Population Growth) instrument be?
- (2) What are the beliefs of PSTs concerning HPG effects?

Method

Study Context

This study was conducted in Turkey, one of the world's 20 most populated countries (UNFPA, 2015), where HPG trends put pressure on the country's carrying capacity and ecological footprint (WWF, 2014). These effects have been listed in Turkey's National Development Plans (NDPs) (MoD 2013, 2019) and the WWF's (2012) *Turkey Ecological Footprint Report*. Turkey's 10th NDP noted that these challenges would lead to adverse consequences for the country and required a resolution (MoD, 2013). According to the WWF (2012), there is a positive correlation between Turkey's HPG trends and ecological footprint, and it may not be ready to fulfil its growing population's demands. For these reasons, implementation of SD policies has gained prominence in meeting demands resulting from HPG trends in the country.

Sample

Two samples were constituted for the development and validation of the BEHPG instrument. Random sampling was not possible, so demographic and characteristic data were requested from participants to describe the nature of the samples (Fraenkel et al., 2006) and to guide claims about the generalizability of the findings of this study.

Our instrument was piloted with 325 pre-service teacher volunteers from three public universities in Turkey. Basic demographic information, participants' experiences

concerning population movements were requested. For the main study, the target population was all PSTs who were enrolled in Faculties of Education in Ankara, Turkey. The accessible population included all PSTs in the Faculty of Education at a public university in Ankara, Turkey. This public university has made some effort to integrate the vision of sustainability into education programs and campus life. Accordingly, a total of 658 PSTs pursuing different undergraduate teacher education programs were purposively selected to participate in the study. Particular attention was paid to demographic information such as gender, age, department, and grade level to obtain a representative sample from the population (Table 1 and Figures 1 and 2).

Table 1

Descriptive Statistics of Categorical Variables in the Main Sample

		Frequency (n)	Percentage (%)
Gender	Female	509	77.3
	Male	142	21.6
	Missing	7	1.1
	Total	658	100
Grade Level	Freshman	133	20.2
	Sophomore	210	31.9
	Junior	150	23.0
	Senior	165	24.9
	Total	658	100

Figure 1

Number of Siblings in Participants' Families in the Main Sample

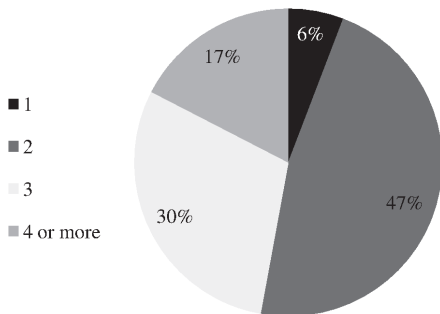


Figure 2

Family Size of the Main Sample

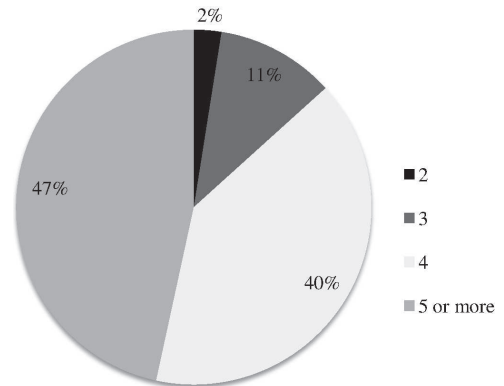


Table 1 shows that most participants were female (77.3%) and their year in school had similar percentages with the sample of pilot study, except for sophomore students (31.9%). Most participants had four or more people in their households. Only 6% had no sibling. A total of 37.1% of the participants were located in a metropolitan area, while 12.0% lived in rural areas. Since these data were similar to that of the pilot sample it could be inferred that the instrument was implemented in similar settings.

Instrumentation

Instrument development and validation have been extensively described in literature (e.g., Crocker & Algina, 1986; Tabachnick et al., 2007). We followed the item construction stages pointed out by Crocker and Algina (1986), which had been used widely in EE and ESD.

Stage 1: Determining the Scope of HPG

We decided to limit our scope to beliefs about HPG effects on environment, economy, society, and natural resources for a sustainable future, as controversial issues constituted a theme in ESD (Summers et al., 2003; Villanen, 2014). Further, we chose *belief* as a theoretical framework for the BEHPG instrument since it did not require professional background knowledge and would allow for more diverse perspectives.

Based on related literature, researchers compiled instrument items from the following sources: scientific articles associated with HPG (e.g., Mfono, 1993; Yang et al., 2010; Orimoogunje et al., 2011), course books on population (e.g., Ehrlich & Ehrlich, 1972; Weeks, 2012), and book chapters related to population (e.g., Raven & Berg, 2006; Weeks, 2012). Furthermore, statistical indicators reported in National Development Plans (MoD, 2013, 2019) and UNFPA were reviewed to acquire more information on current HPG globally and in Turkey.

Stage 2: First Draft of the Instrument

Ramsey et al. (1989) process for critical analysis of environmental issues was followed to identify HPG belief statements. We also identified stakeholders of the current HPG debates in both national and international publications since their reasons for taking a particular position in HPG debates as an indicator of HPG beliefs provided a global vision for designing the instrument. Thus, the issue analysis method was used for item construction instead of participant interviews. If we had relied on the interview approach, the BEHPG instrument might not have covered all possible HPG beliefs and might have been limited to a narrowed range of participants' beliefs. Items were written and clarified based on the Edwards criteria (Edwards, 1994), enhancing their interpretability and eliminating ambiguity. Five items were adapted from previously developed instruments related to environmental issues (Dunlap et al., 2000; Karakaya & Çobanoğlu, 2012; Karakoç, 2005). Finally, the first draft of the instrument dimensions was pre-determined as follows: (1) population and environment (26 items); (2) population and economy (22 items); and (3) population and society (28 items) measured on a five-point Likert scale.

Stage 3: Second Draft of the Instrument

To assess content validity, expert opinions were obtained through a three-stage process. At the first stage, two elementary science education experts and one sociology expert, all of whom had undertaken extensive research on sustainability and population growth, examined the instrument. Based on their suggestions, 14 items were reconstructed and eight were removed. The resulting 54 items were included in the pilot instrument.

The second stage of instrument development was a language revision and comprehensibility check. A Turkish language specialist reviewed the instrument to assess its

clarity. At the last stage, a science education expert checked the comprehensibility of the instrument and the time it took to administer it.

Stage 4: Pilot Study – Defining the Final BEHPG Instrument

The pilot BEHPG instrument was administered to 325 participants. It was implemented in Turkish and translated into English by a native speaker fluent in both languages. Another expert completed the back-translation process to check translation accuracy.

Exploratory factor analysis (EFA) was conducted on participant responses to determine the instrument dimensions. Based on results from the EFA and reliability analysis, item deletion and revisions were performed using the IBM SPSS Statistics 20. The final version of the instrument comprised 41 items.

Stage 5: Implementation of the Main Study

The 41-item BEHPG instrument was administered to 658 PSTs. EFA and confirmatory factor analysis (CFA) were applied to determine the congruence of the instrument dimensions between the pilot and main studies. EFA and reliability analysis were both conducted. CFA was performed using LISREL 8.8.

Ethical Procedures

Both studies were conducted with approval from the Ethics Committee of the *Research Center for Applied Ethics*. All procedures involving human participants were in accordance with the ethical standards of the institutional research committee. Informed consent was obtained from all participants.

Data Collection

Data were collected in two steps. First, the pilot study was implemented. After the revision process, the main study was administered. Both were implemented in classroom settings. Participants completed the instrument on paper. Both instrument versions took approximately 25–30 minutes to complete.

To minimize internal validity threats, some procedures recommended by Fraenkel, Wallen and Hyun (2006) were followed. For instance, data collection conditions were standardized. Further, all instrument was administered in classroom settings and at a single point in time.

Data Analysis

Data analysis comprised five stages: (1) determining the factor structure based on EFA; (2) confirming factors proposed in the pilot study by performing EFA and CFA; (3) calculating Cronbach's alpha for each dimension; (4) calculating item-total correlation; and (5) conducting descriptive statistics to examine HPG beliefs.

Results

Development of the BEHPG Instrument

Results of the Pilot Study: Defining the Final BEHPG Instrument

EFA was applied to examine the construct-related validity evidence of the instrument. Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy were applied prior in order to provide assumptions for factorability. Bartlett's test of sphericity produced a value, $\chi^2(666) = 4,850.01$, $p < .000$, and the KMO index was 0.92. Tabachnick and Fidell (2007) indicated that five participants were sufficient for each item to conduct the factor analysis. Accordingly, 325 participants were deemed more than sufficient to conduct this EFA.

We conducted a principal component analysis (PCA), with an unrotated solution, to decide the instrument dimensions. During the second phase, we applied a varimax rotation method to the factors to offer meaningful interpretations of the dimensions. After the first trial, the PCA derived six dimensions with eigenvalues greater than 1.0. The scree plot indicated four dimensions. Overall, four of these six dimensions were represented by items with rotated factor loadings higher than ± 0.30 which revealed strong relationship between the items and the dimensions (Stevens, 2002; Pallant, 2007). In brief, results of the pilot implementation showed a moderate congruence between the researchers' conceptual dimensions used to design the BEHPG and the empirical dimensions proposed as a result of the EFA.

Testing Reliability of the Pilot BEHPG Instrument

We conducted reliability analyses by selecting items loaded on the same dimension. From the Cronbach's alpha criteria, the pilot instrument had good reliability values (Table 2). In addition, item-total correlation values of each item were also calculated, and all values were higher than 0.3 (Pallant, 2007) which also provided another indicator for internal consistency.

Table 2

Reliability of Each Dimension in the Pilot Study

Dimensions	Cronbach's Alpha
HPG, Nature, and Development	.91
Requirements to support HPG	.87
HPG, Resources, and Environment	.70
HPG and National Economy	.76

*HPG: Human Population Growth

Reviewing the BEHPG Instrument

The BEHPG instrument was revised after the pilot. Thirteen draft items were deleted since they either did not load any of the dimensions or loaded more than one dimension. Deletion of similar items was based on factor-loading values found in the rotated component matrix table. Next, four items in the pilot version were revised and rewritten based on dimension configuration.

Some items loaded on more than one dimension. If the difference between loadings was greater than 0.30 (Tabachnick & Fidel, 2007), the items were retained within dimensions that had the greater loading value. The final decision was to include these revised items in the main study. As a result, EFA was replicated using data from the main study to decide the final dimension configuration.

Results of the Main Study

We applied EFA to determine congruence between dimensions of the pilot and main studies before generating a model from the data. The value of Bartlett's test of sphericity was $\chi^2(666) = 8725.53, p < .000$ and the KMO value was 0.94. The sample size was 658 participants.

At the first stage, EFA indicated six dimensions with eigenvalues greater than 1.0 (Table 3). The scree plot (Figure 3) identified five dimensions.

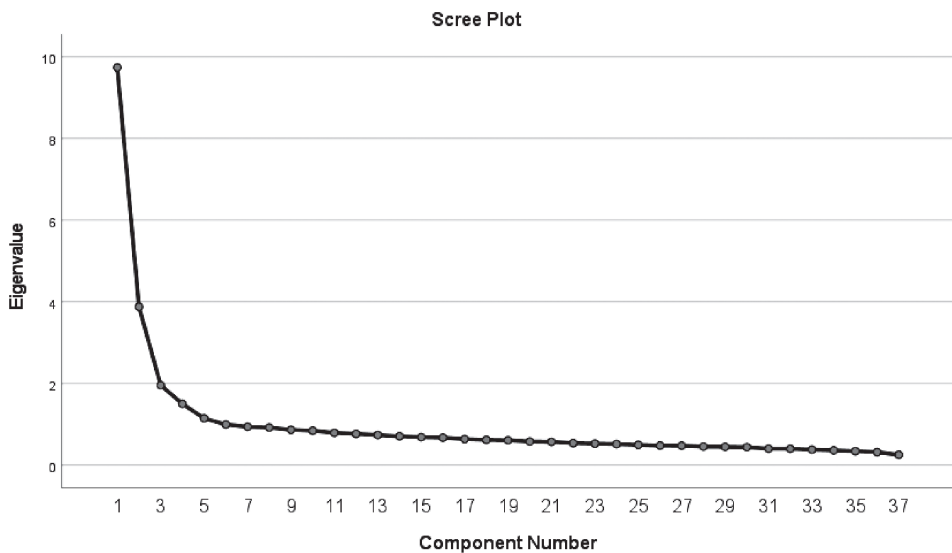
Table 3

Initial Eigenvalues of the Dimensions of the Main Study

Component	Initial eigenvalues		
	Total	% of variance	Cumulative %
1	9.740	26.324	26.324
2	3.881	10.489	36.813
3	1.958	5.291	42.104
4	1.501	4.058	46.162
5	1.146	3.096	49.258

Figure 3

Scree Plot for the Main Study



Five dimensions were rotated during the second stage of factor analysis using the varimax rotation method. Four items (9, 21, 33, and 36) were deleted because they did not load any of the dimensions (Table 4). Cronbach's alpha values are presented in Table 5.

Table 4

Items Deleted from the BEHPG Instrument

Deleted items	
9)	Population growth in underdeveloped countries harms their economy.
21)	Rural to urban migration leads to cultural conflicts.
33)	In an economic system in which consumption is encouraged, solving the problems rooted from population growth will not be possible.
36)	Rural-urban migrants lose their cultural values over time.

BEHPG: Beliefs on the effects of human population growth.

Table 5

Reliability of Each Factor in the BEHPG Instrument

Dimensions	Cronbach Alpha	Dimensions	Cronbach Alpha
Requirements to Support Human Population Growth	.89	Quality of Human Life	.80
Neo-Malthusian Environmentalism	.83	Population, Resources and Environment	.66
Population and National Economy	.82		

BEHPG: Beliefs on the effects of human population growth.

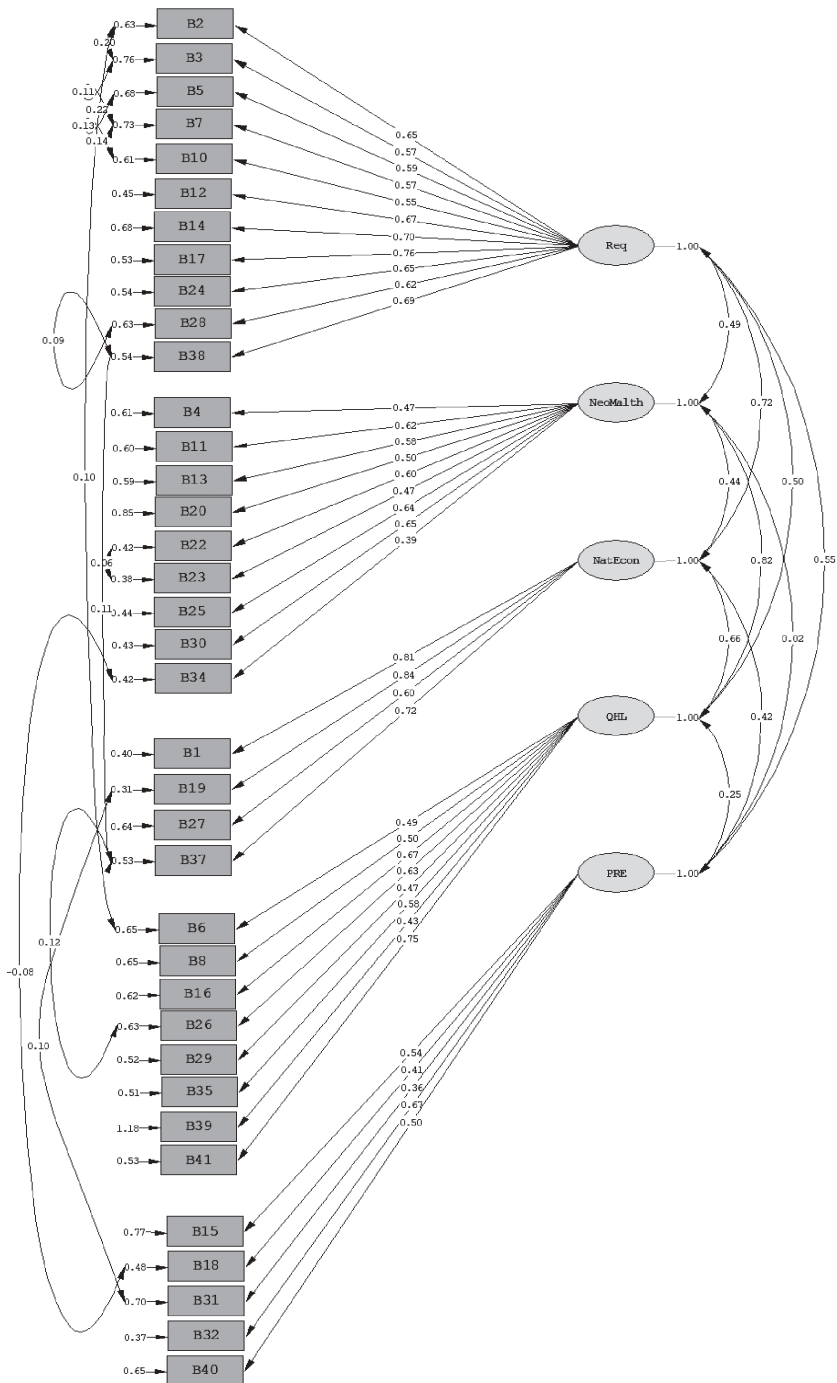
The Cronbach's alpha coefficients in this study ranged between 0.66 and 0.89. Based on the Cronbach's alpha criteria, the BEHPG instrument had "adequate" reliability values (Vaske et al., 2017). Item-total correlation values of each item were also calculated, and all values were higher than 0.3 (Pallant, 2007) which provided another indicator for internal consistency.

According to the items loaded, the first dimension, titled *population, environment, and development* in the pilot study, was divided into two sub-dimensions: *neo-Malthusian environmentalism* and the *quality of human life*. The final instrument containing 37 items indicated a considerable congruence with the dimensions of the pilot.

The proposed model based on the EFA results was tested with CFA. Kline (1998) suggested that, in most cases, multivariate non-normality could be explored by checking univariate distributions. A skewness value greater than 3.0 and kurtosis value greater than 10 may reveal univariate non-normality. For this study, the skewness values (-0.49–0.35) and kurtosis values (-0.48–0.15) of observed variables did not suggest a problem of non-normality. Therefore, maximum likelihood estimation using normal scores was used. The model obtained from the CFA is presented in Figure 4.

Figure 4

Path Diagram of the Dimensions of the Instrument



Chi-Square=1258.36, df=607, P-value=0.00000, RMSEA=0.040

Multiple goodness-of-fit tests were applied to test the fit between data from the main study and those proposed in the EFA. The root mean square error of approximation (RMSEA) was 0.04, which represented a good fit (Steiger & Lind, 1980; Kline, 1998). The goodness of fit index (0.91) and comparative fit index (.92) also represented good fit (Brown, 2006). The root mean square residual (.05) indicated reasonable fit (Brown, 2006). The normed Chi-Square or χ^2/df was 2.07, which represented good fit. Overall, the main study values confirmed that the five-factor model of the BEHPG instrument five-factor model had good fit with data from the LISREL output.

BEHPG Instrument and Beliefs of Pre-service Teachers

For the second research question, descriptive statistics were used to identify PSTs' beliefs toward HPG effects. Table 6 presents the translated items in the final version of the BEHPG, rotated factor loadings, and each item descriptive results in terms of percentage.

Table 6

Factor Loadings and Percentage of the Answers for the Items

Items	Factor loadings	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
<i>Quality of Human Life</i>						
National per capita income decreases as the population grows in our country.	0.738	2.6	13.1	21.2	42.0	21.2
Population growth negatively affects long-term human health.	0.424	2.0	27.8	26.6	39.0	4.6
Population growth reduces the quality of life in urban areas.	0.406	1.4	26.1	32.6	33.1	6.9
Immigrants bring about economic problems in their adopted country.	0.399	1.5	10.9	23.1	54.4	10.1
The number of poor people increases as population grows.	0.379	4.3	17.3	27.3	38.0	13.1
Population growth reduces the quality of government education and health services for the poor.	0.325	2.6	13.8	20.1	45.0	18.5
The primary reason for unemployment is the large young population in our country.	0.309	11.3	31.5	22.8	25.0	9.3
Population growth in our country increases energy demand and hinders economic development.	0.308	2.4	12.5	30.5	44.7	9.9
<i>Neo-Malthusian Environmentalism</i>						
The amount of clean water decreases with population growth.	0.631	1.2	11.2	16.6	52.6	18.4
Air pollution increases with population growth.	0.697	2.3	8.4	8.5	50.3	30.5
Population growth influences natural cycles negatively.	0.598	1.8	9.6	24.0	48.2	16.4
Uncontrolled population growth accelerates climate change.	0.456	4.4	17.1	24.8	40.7	11.9

See next page for continuation of table

Continuation of Table 6

Population growth depletes natural resources (i.e., water, air, minerals).	0.636	1.5	8.1	14.3	55.6	20.5
Population growth diminishes global capacity to support human life.	0.584	2.4	11.5	19.4	46.6	20.0
Environmental problems caused by population growth result in long-term economic problems.	0.535	0.8	4.9	14.8	60.1	19.5
Environmental pollution increases with population growth.	0.595	2.3	5.6	7.2	51.7	33.2
In our country, population growth due to rural–urban migration leads to greater environmental problems.	0.505	0.9	4.3	11.6	60.4	22.8
<i>Requirements to Support Human Population Growth</i>						
Population can grow if the national per capita income is sufficient.	0.743	4.6	27.8	19.9	42.3	5.4
Population growth is not negative if individuals are economically productive.	0.750	3.9	16.7	22.2	46.0	11.3
Population growth is not negative when urbanization is planned.	0.689	4.0	19.2	18.0	49.0	9.9
Population growth does not lead to any problems (environmental, economic, social) as long as individuals are socially equal.	0.699	4.8	26.2	25.2	36.5	7.4
Population growth is not a problem when all can equally benefit from government social services.	0.645	5.8	29.0	22.5	37.2	5.5
Increased national production improves the quality of people's lives.	0.602	3.2	18.4	30.8	40.4	7.2
Population growth improves environmental quality if people live in harmony with their environment.	0.322	5.6	25.9	32.0	30.5	5.9
Population growth is not damaging if people are careful about consumption.	0.577	3.4	31.6	28.2	33.9	2.9
Population growth is not a problem if scientific and technological developments can solve related problems.	0.492	4.1	24.8	30.6	34.9	5.6
Population can grow as long as it is not harmful to living things.	0.462	8.2	32.6	24.1	28.7	6.3
Population growth does not affect the environment negatively providing there is fair distribution of natural resources.	0.407	5.7	26.0	31.4	30.9	6.0
<i>Population, Resources and Environment</i>						
The primary cause of environmental problems is not population growth but unthinking use of natural resources.	0.748	1.1	7.0	11.5	47.2	33.2
Today's environmental problems are rooted in the consumption patterns of natural resources in developed countries rather than human population growth.	0.613	1.7	11.3	26.5	43.1	17.4
Self-interested consumption of natural resources causes environmental degradation far more rapidly than population growth.	0.641	1.4	2.6	7.4	46.0	42.6

See next page for continuation of table

Continuation of Table 6

The primary reason for environmental problems is not population growth but mismanagement of natural resources on a global scale.	0.537	2.9	13.4	24.1	40.5	19.1
Dispersion patterns of human populations have greater negative effects on the environment than population growth.	0.434	1.5	8.8	20.7	49.7	19.2
<i>Population and National Economy</i>						
Population growth is essential for our country's economic development.	0.654	9.8	35.0	26.6	26.0	2.7
Population growth is important for our country's welfare.	0.743	19.0	34.7	30.1	13.7	2.6
Population growth should be supported because a young population is crucial to our country's economic development.	0.673	5.2	21.8	33.9	31.8	7.3
Population growth in developing countries is essential for economic growth.	0.617	5.6	17.7	34.2	35.0	7.5

Results presented in Table 6 indicate that PSTs believed that HPG generally reduced the QHL as well as education quality and health services. More than half the PSTs agreed that rural-to-urban migration, which could also be considered a manifestation of HPG, led to cultural conflicts, cultural loss, and economic problems, while most were pessimistic about the environment state. For example, they held beliefs that the Earth's carrying capacity was about to be exceeded because of HPG (65.1%) and that there was a positive correlation between HPG and environmental pollution (85.0%), air pollution (80.8%), water pollution (71.3%), climate change (51.8%), depletion of resources (75.8%), and disruption of natural cycles (63.7%). Conversely, over 40% of participants reported that HPG would not constitute a problem if appropriate precautions were taken to help solve HPG-based problems, such as planned urbanization (61.1%), providing equal opportunities by accessing social services (44.4%), being economically productive (59.6%), and pursuing science and technology development (43.0%). Nevertheless, over 60% of PSTs stated that environmental problems were not only caused by HPG, but rather by mismanagement (60.4%), unconscious usage (80.4%), self-interest-based consumption of natural resources (88.8%), and population dispersion patterns (69.9%). However, PSTs remained undecided about interactions between HPG and the national economy; approximately one-third of PSTs were undecided about items that supported HPG for economic reasons.

Discussion and Conclusion

Reorienting education policies and curriculum frameworks to achieve Sustainable Development Goals is essential. Alongside with these changes, revising teacher education policies and equipping teachers with necessary knowledge and skills for teaching sustainability issues have also equal importance. Compatible with JTES approaches to sustainability (Salite et al., 2019), we believe that 'broader and deeper re-evaluation of the role of pedagogical science' is an important philosophical approach to understand the nature of the complex and nested nature of the sustainability. At this point, examining PSTs' beliefs towards the sustainability issues could provide an insight while constructing

policies and frameworks because their beliefs have a potential to interact with their teaching practices as well as students' beliefs, attitudes, and behaviors (Pajares, 1992; Richardson, 1996; Bloom & Ellis, 2009). In this study, we chose to explore PSTs' beliefs on the effects of HPG because it is one of the wicked problems in sustainability and includes contrasting values.

Pre-Service Teachers' Beliefs on the Effects of HPG

PSTs' beliefs were determined using the BEHPG instrument. Some of the PSTs' beliefs were similar to results reported in previous studies. For example, PSTs of this study believe that HPG poses a problem for carrying capacity, natural resource depletion, environmental problems, and QHL. In a similar manner, the previous studies (Alkahrer & Carmi, 2019; Holl et al., 1999; Reeder et al., 1974) reported similar concerns of the participants. Thus, it can be concluded that these results were compatible with the related literature. On the other hand, the present study elaborated some of the effects of HPG that PSTs remained undecided. Approximately, one third of PSTs remained undecided on the interactions among HPG, urbanization, migration, energy demand, national economy and technological improvements. The possible reasons for this uncertainty, although speculative, could be listed as follows: (1) they might have limited knowledge of HPG as Alkahrer and Carmi (2019) and Holl et al. (1999) emphasized; (2) they just remained undecided even though they had necessary background knowledge; or (3) they might fail to accommodate their background knowledge on economy, environment, and society into the context of multiple and nested effects of HPG. Further evidence is needed to find out other factors that may be related to or contribute to this indecision. Yet, to promote PSTs' knowledge and skills on HPG, these concepts might be considered to integrate ESD implementations of the teacher education program. After all, PSTs from different departments might not be familiar with all these concepts. At this point, using BEHPG instrument could guide how to integrate those issues into teacher education curricula.

When PSTs' beliefs of this study were interpreted in terms of BEHPG dimensions, some inconsistent beliefs were apparent regarding HPG effects. As formerly stated, the majority of PSTs believed that HPG led to environmental degradation, depletion of natural resources and reduction of QHL. In contrast, they also claimed that environmental problems were not caused primarily by HPG but rather by the mismanagement of natural resources and consumption patterns prevailing in developed countries. There may be different explanations for these inconsistent beliefs. PSTs who participated in this study might have experienced negative effects of HPG on the environment, natural resources and QHL in their daily lives in Turkey. In addition, they might be also familiar with the popular debate about HPG rates and consumption pattern rates between developing and developed countries (e.g., Miller & Spoolman, 2016; Edet & Sunday, 2018). Accordingly, both negative experiences and information about this debate may then contribute to shaping their beliefs. Alternatively, PSTs may also form beliefs based on influences from an outside source (e.g., Internet, TV, friends) whose level of accuracy is unknown. Last, they might not have educational backgrounds related to HPG, as Alkahrer and Carmi (2019) highlighted, in the ESD context and thus might have formed their beliefs by drawing upon different sources and direct experiences; this might result in detached and inconsistent beliefs. At this point, further qualitative studies could shed light on the potential reasons for these inconsistent beliefs.

Dimensionality of the BEHPG Instrument and Description of Its Dimensions

Valid and reliable instruments are substantial elements in gathering data for analysis (Fraenkel et al., 2006). Accordingly, this study attempted to collect proper evidence of validity and reliability to determine the instrument construct validity (Crocker & Algina, 1986). The values of fit indices and rotated factor loadings indicated a strong relationship between the items and dimensions. Reliability values of each dimension and item-total correlation values revealed adequate-to-good internal consistency. Thus, we conclude that the BEHPG instrument is a promising tool to determine HPG beliefs among PSTs in Turkey and, potentially, beyond.

At the early stages of the study, we proposed three conceptual dimensions based on related literature and expert opinions. However, the results revealed that items constituting HPG were grouped under five empirical dimensions that were moderately consistent with those proposed. The pre-dimension *population and the environment* pertained to interactions between HPG and the environment. However, this pre-dimension was divided into two issues, and this was compatible with the HPG literature. Neo-Malthusian environmentalism, and mismanagement of natural resources are the two most-mentioned arguments with respect to HPG effects. Neo-Malthusians support the contention that HPG results in environmental deterioration and depletion of natural resources (e.g., Ehrlich & Ehrlich, 1972; Hardin & Baden, 1977; Taylor & Barrios, 1999). However, this perspective has been criticized by scholars (e.g., Sagoff, 1994; George et al., 2018), who reported that overconsumption of natural resources had more detrimental effects than HPG.

The pre-dimension *population and the economy* contained items related to interactions between HPG and the economy. Items related to issues such as national income per capita, education and health services, unemployment and poverty were represented in the *quality of human life* dimension, whereas the remaining items linked to national economy constituted the *population and national economy* dimension. Items in the *QHL* dimension reflected elements of the *human development index* defined by the UN (Wolff et al., 2011), and Turkey's NDP (MoD, 2013) has continuously reported that HPG affects the QHL. Interactions between HPG and the national economy are also appearing in popular HPG debates. Hence, both dimensions in our study are compatible with HPG literature.

Items related to minimum environmental, economic, and social requirements to support the increasing population constituted a different dimension: *requirements to support HPG*. As the context of the items reflects (Table 6), HPG is managed through principles of SD. Issues presented through the items are valid for both developing and developed countries since they reflect social, environmental and economic problems caused by HPG and the exceeding of carrying capacity due to overconsumption patterns.

Implications and Recommendations

Our results can only be generalized to the population from which the main sample was chosen via purposive sampling. Nevertheless, the instrument items were constructed based on global HPG literature. Hence, it has a potential to be implemented in different sample settings (students, public participation, etc.) and countries. However, different dimension configurations may be formed in other sample settings, so future studies may

consider different dimensionality constructs. We also suggest that further studies should combine various statistical techniques with the survey method to gain a deeper understanding of the nature of HPG beliefs.

The BEHPG instrument could be a promising tool to be administered on any sample of PSTs throughout the world regardless of the degree of development. Implementation of this instrument in different countries may highlight the positions of PSTs and present specific routes for policymakers or educators to integrate their HPG trends into ESD implementation of teacher education programs. Such implementation will help countries improve their ESD context and take us closer to achieving a sustainable future.

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References

- Alkahr, I., & Carmi, N. (2019). Is population growth an environmental problem? Teachers' perceptions and attitudes towards including it in their teaching. *Sustainability*, 11(7), 1994. <https://doi.org/doi:10.3390/su11071994>
- Arora-Jonsson, S. (2017). Blind spots in environmental policy-making: How beliefs about science and development may jeopardize environmental solutions. *World Development Perspectives*, 5, 27–29. <https://doi.org/10.1016/j.wdp.2017.02.004>
- Bell, C. V., & Odom, A. L. (2013). Understanding current and potential consequences of population growth. *Science Activities: Classroom Projects and Curriculum Ideas*, 50(3), 73–83. <https://doi.org/10.1080/00368121.2013.803011>
- Bloom, P. J., & Ellis, L. (2009). Helping teachers identify and articulate their values and beliefs. *The Director's Link*, 1–3. <http://mccormickcenter.nl.edu/helping-teachers-identify-and-articulate-their-values-and-beliefs/>
- Boon, H. J. (2011). Beliefs and education for sustainability in rural and regional Australia. *Education in Rural Australia*, 21(2), 37–54. <https://search.informit.org/doi/10.3316/aeipt.191911>
- Brickhouse, N., & Bodner, G. (1992). The beginning science teacher: Classroom narratives of convictions and constraints. *Journal of Research in Science Teaching*, 29(5), 471–485. <https://doi.org/10.1002/tea.3660290504>
- Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. The Guilford Press.
- Burmeister, M., & Eilks, I. (2013). An understanding of sustainability and education for sustainable development among German student teachers and trainee teachers of chemistry. *Science Education International*, 24(2), 167–194. <https://files.eric.ed.gov/fulltext/EJ1015833.pdf>
- Corraliza, J. A., & Berenguer, J. (2000). Environmental values, beliefs, and actions: A situational approach. *Environment and Behavior*, 32(6), 832–848. <https://doi.org/10.1177/00139160021972829>
- Cotton, D. R. (2006). Implementing curriculum guidance on environmental education: The importance of teachers' beliefs. *Journal of Curriculum Studies*, 38(1), 67–83. <https://doi.org/10.1080/00220270500038644>

- Cotton, D. R., Warren, M. F., Maiboroda, O., & Bailey, I. (2007). Sustainable development, higher education and pedagogy: A study of lecturers' beliefs and attitudes. *Environmental Education Research*, 13(5), 579–597. <https://doi.org/10.1080/13504620701659061>
- Crocker, L. M., & Algina, J. (1986). *Introduction to classical and modern test theory*. Holt, Rinehart and Winston Inc.
- Cronin-Jones, L. L. (1991). Science teacher beliefs and their influence on curriculum implementation: Two case studies. *Journal of Research in Science Teaching*, 28(3), 235–250. <https://doi.org/10.1002/tea.3660280305>
- Dunlap, R. E. V. L., Liere, K. V., Mertig, A., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale. *Journal of Social Issues*, 56(3), 425–442. <https://doi.org/10.1111/0022-4537.00176>
- Echegoyen-Sanz, Y., & Martín-Ezpeleta, A. (2021). A holistic approach to education for sustainability: Ecofeminism as a tool to enhance sustainability attitudes in pre-service teachers. *Journal of Teacher Education for Sustainability*, 23(1), 5–21. <https://doi.org/10.2478/jtes-2021-0002>
- Edet, E. A., & Sunday, E. (2018). Environmental degradation, north-south debate and sustainable development. *Socialscientia: Journal of Social Sciences and Humanities*, 2(4). <https://journals.aphriapub.com/index.php/SS/article/view/606>
- Edwards, A. L. (1994). *Techniques of attitude scale construction*. Irvington.
- Ehrlich, P. R., & Ehrlich, A. H. (1972). *Population, resources and environment: Issues in human ecology*. W. H. Freeman and Company.
- Engels, F. (1844). Outlines of a critique of political economy. *Deutsch-Französische Jahrbücher*, 1(1). https://tilde.town/~xat/rt/pdf/engels_1843_outline_political_economy.pdf
- Fishbein, M. A., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Addison-Wesley.
- Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2006). *How to design and evaluate research in education*. McGraw-Hill.
- George, G., Schillebeeckx, S. J., & Liak, T. L. (2018). The management of natural resources: An overview and research agenda. In G. George & S. J. Schillebeeckx (Eds.), *Managing natural resources: Organizational strategy, behaviour and dynamics* (pp. 1598–1613). Edward Elgar Publishing.
- Hardin, G., & Baden, J. (Eds). (1977). *Managing the commons*. W. H. Freeman Company.
- Hepper, J. (2021). Making change visible – An explorative case study of dealing with climate change deniers in forest education. *Journal of Teacher Education for Sustainability*, 23(1), 58–68. <https://doi.org/10.2478/jtes-2021-0005>
- Hess, D. J., & Maki, A. (2019). Climate change belief, sustainability education, and political values: Assessing the need for higher-education curriculum reform. *Journal of Cleaner Production*, 228, 1157–1166. <https://doi.org/10.1016/j.jclepro.2019.04.291>
- Holl, K. D., Daily, G. C., Daily, S. C., Ehrlich, P. R., & Bassin, S. (1999). Knowledge of and attitudes toward population growth and the environment: University students in Costa Rica and the United States. *Environmental Conservation*, 26(1), 66–74. <https://doi.org/10.1017/S0376892999000107>

- Jickling, B., & Wals, A. E. (2012). Debating education for sustainable development 20 years after Rio: A conversation between Bob Jickling and Arjen Wals. *Journal of Education for Sustainable Development*, 6(1), 49–57. <https://doi.org/10.1177/097340821100600111>
- Johnson, V., & Nurick, R. (1995). Behind the headlines: The ethics of the population and environment debate. *International Affairs*, 71(3), 547–566. <https://doi.org/10.2307/2624840>
- Karakaya, Ç., & E. O. Çobanoğlu. (2012). İnsanı Merkeze Alan (Antroposentrik) Ve Almayan (Nonantroposentrik) Yaklaşımlara Göre Eğitim Fakültesi Son Sınıf Öğrencilerinin Çevreye Yönelik Bakış Açılımları [Perspectives of pre-service teachers on the environment according to anthropocentric and non-anthropocentric approaches]. *Journal of Turkish Science Education*, 9(3), 23–35.
- Karakoç, A. G. Y. (2005). *Environmental ethics approach in the world and in Turkey* (Unpublished doctoral dissertation). Middle East Technical University.
- Keys, C. W., & Bryan, L. A. (2001). Co-constructing inquiry-based science with teachers: Essential research for lasting reform. *Journal of Research in Science Teaching*, 38(6), 631–645. <https://doi.org/10.1002/tea.1023>
- Kline, R. B. (1998). *Principles and practice of structural equation modeling*. The Guilford Press.
- Kohl, K., & Hopkins, C. (2020). Learnings from the #IndigenousESD global research: Twenty-first century competencies for all learners. *Journal of Teacher Education for Sustainability*, 22(2), 90–103. <https://doi.org/10.2478/jtes-2020-0018>
- Lind, H. B., Nordfjærn, T., Jørgensen, S. H., & Rundmo, T. (2015). The value-belief-norm theory, personal norms and sustainable travel mode choice in urban areas. *Journal of Environmental Psychology*, 44, 119–125. <https://doi.org/10.1016/j.jenvp.2015.06.001>
- Maja, M. M., & Ayano, S. F. (2021). The impact of population growth on natural resources and farmers' capacity to adapt to climate change in low-income countries. *Earth Systems and Environment*, 5, 271–283. <https://doi.org/10.1007/s41748-021-00209-6>
- Malthus, T. R. (1798). *An essay on the principle of population*. J. Johnson.
- Marx, K. (1890). *Capital: A critique of political economy*. Penguin.
- Meadows, D. H., Randers, J., & Meadows, D. L. (1972). *The limits to growth*. Yale University Press.
- Mfono, Z. N. (1993). Education and population awareness in developing countries. *Development Southern Africa*, 10(3), 383–391. <https://doi.org/10.1080/03768359308439700>
- Miller, G. T., & Spoolman, S. E. (2016). *Environmental science, fifteenth edition*. Cengage Learning.
- MoD. (2013). *Tenth national development plan*. <https://www.sbb.gov.tr/wp-content/uploads/2018/11/Onuncu-Kalk%C4%B1nma-Plan%C4%B1-2014-2018.pdf>
- MoD. (2019). *Eleventh national development plan*. The Grand National Assembly of Turkey. https://www.sbb.gov.tr/wp-content/uploads/2020/03/On_BirinciPLan_ingilizce_SonBaski.pdf
- Nation, M. T., & Feldman, A. (2021). Environmental education in the secondary science classroom: How teachers' beliefs influence their instruction of climate change. *Journal of Science Teacher Education*, 32(5), 481–499. <https://doi.org/10.1080/1046560X.2020.1854968>

- Nespor, J. (1987). The role of beliefs in the practice of teaching. *Journal of Curriculum Studies*, 19(4), 317–328. <https://doi.org/10.1080/0022027870190403>
- Orimoogunje, O. O., Adegboyega, S. A., Banjo, O. O., & Funmilayo, O. A. (2011). Population growth: Implications for environmental sustainability. *IFE Psychologia: An International Journal*, 19(1), 56–69.
- Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, 62(3), 307–332. <https://doi.org/10.2307/1170741>
- Pallant, J. (2007). *SPSS survival manual: A step by step guide to data analysis using SPSS for windows* (3rd ed). Open University Press.
- Pooley, J. A., & O'Connor, M. (2000). Environmental education and attitudes: emotions and beliefs are what is needed. *Environment and Behavior*, 32(5), 711–723. <https://doi.org/10.1177/0013916500325007>
- Price, J. C., Walker, I. A., & Boschetti, F. (2014). Measuring cultural values and beliefs about environment to identify their role in climate change responses. *Journal of Environmental Psychology*, 37, 8–20. <https://doi.org/10.1016/j.jenvp.2013.10.001>
- Ramsey, J. M., Hungerford, H. R., & Volk, T. (1989). A technique for analyzing environmental issues. *The Journal of Environmental Education*, 21(1), 26–30. <https://doi.org/10.1080/00958964.1989.9941923>
- Raven, P. H., & Berg, L. R. (2006). *Environment*. John Wiley & Sons, Inc.
- Reeder, L. G., Allison, A. A., Bourque, L. B., Hensler, D., & Bailey, K. (1974). Attitudes toward population growth: Demographic predictors. *Social Biology*, 21(4), 360–367. <https://doi.org/10.1080/19485565.1974.9988134>
- Richardson, V. (1996). The role of attitudes beliefs in learning to teach. In J. P. Sikula, T. J. Buttery, & E. Guyton (Eds.), *Handbook of research on teacher education: A project of the association of teacher educators* (pp. 102–119). Macmillan.
- Sagoff, M. (1994). Population, nature and the environment. In L. A. Mazur (Ed.), *Beyond the numbers: A reader on population, consumption and the environment* (pp. 33–39). Island Press.
- Salite, I., Fjodorova, I., Meihami, H., Ivanova, O., Iliško, D., & Gholami, J. (2019). JTES approaches to sustainability: Current practices and new perspectives for a more sustainable world. *Journal of Teacher Education for Sustainability*, 21(2), 1–4. <https://doi.org/10.2478/jtes-2019-0012>
- Salite, I., Fjodorova, I., Butlere, I., & Ivanova, O. (2021). More personal knowledge for more sustainable higher education. *Journal of Teacher Education for Sustainability*, 23(1), 150–165. <https://doi.org/10.2478/jtes-2021-0011>
- Sleurs, W. (2008). *Competencies for ESD (Education for Sustainable Development) teachers: A framework to integrate ESD in the curriculum of teacher training institutes*. Comenius 2.1 Project.
- Steele, F. (2010). *Mainstreaming education for sustainability in preservice teacher education: Enablers and constraints*. A report prepared by the Australian Research Institute in Education for Sustainability for the Australian Government Department of the Environment, Water, Heritage and the Arts. http://aries.mq.edu.au/projects/preservice3/Pre-Service_Teacher_Ed3.pdf
- Steiger, J. H., & Lind, J. C. (1980, May 30). *Statistically based tests for the number of common factors*. [Conference session]. The Psychometric Society Annual Meeting, Iowa City, IA.

- Stevens, J. (2002). *Applied multivariate statistics for the social sciences*. Erlbaum.
- Stevenson, R. B., Ferreira, J. A., Evans, N. S., & Davis, J. (2015). Beyond science education: Embedding sustainability in teacher education systems. In S. Stratton, R. Hagevik, A. Feldman, & M. Bloom. (Eds.), *Educating science teachers for sustainability. ASTE series in science education* (pp. 381–398). Springer.
- Suleimenova, A., & Ivanova, O. (2018). Emotional competence and individual style of action of future teachers of higher education in the system of education for sustainable development. *Journal of Teacher Education for Sustainability*, 20(2), 44–63. <https://doi.org/10.2478/jtes-2018-0014>
- Summers, M., Corney, G., & Childs, A. (2003). Teaching sustainable development in primary schools: An empirical study of issues for teachers. *Environmental education research*, 9(3), 327–346. <https://doi.org/10.1080/13504620303458>
- Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2007). *Using multivariate statistics*. Pearson Education.
- Taylor, P. J., & García-Barrios, R. (1999). The dynamics of socio-environmental change and the limits of neo-malthusian environmentalism. In T. D. Mount, H. Shue, & M. H. I. Dore (Eds.), *Global environmental economics: Equity and the limits to markets* (pp. 139–167). Blackwell.
- The global science panel on population in sustainable development. (2002). *Population and Development Review*, 28(2), 367–69. <http://www.jstor.org/stable/3092830>
- Tomas, L., Girgenti, S., & Jackson, C. (2017). Pre-service teachers' attitudes toward education for sustainability and its relevance to their learning: Implications for pedagogical practice. *Environmental Education Research*, 23(3), 324–347. <https://doi.org/10.1080/13504622.2015.1109065>
- UNESCO-UNEP. (1990). Environmentally educated teachers: The priority of priorities. *Connect XV* (1), 1–3.
- UNESCO. (2005). *Guidelines and recommendations for reorienting teacher education to address sustainability*. UNESCO Education for Sustainable Development in Action, Technical Paper No. 2. (Prepared by UNITWIN/UNESCO Chair on Reorienting Teacher Education to Address Sustainability [Charles Hopkins, Chair and Rosalyn McKeown, Secretariat] and the International Network of Teacher-Education Institutions). UNESCO.
- UNESCO. (2017). *Education for sustainable development goals: Learning objectives*. UNESCO.
- United Nations Population Division [UNFPA]. (1994). *International Conference on Population and Development*. Cairo, Egypt.
- United Nations Population Division [UNFPA]. (2004). *World population to 2300*, ST/ESA/SER.A/236.
- United Nations. (2012). *Rio +20 – United Nations Conference on Sustainable Development (A/CONF.216/L.1)*. United Nations.
- United Nations Conference on Environment and Development [UNCED]. (1992). *Agenda 21, Rio Declaration, Forest Principles*. United Nations.
- United Nations, Department of Economic and Social Affairs, Population Division [UNDESA]. 2017. *World population prospects: The 2017 revision, key findings and advance tables* (ESA/P/WP/248). United Nations.
- United Nations General Assembly. (2015). *Transforming our world: The 2030 agenda for sustainable development (A/RES/70/1)*. <https://www.refworld.org/docid/57b6e3e44.html>

- UNFPA. (2015). *State of world population 2015 – shelter from the storm. A transformative agenda for women and girls in a crisis-prone world*. UNFPA.
- UNFPA. (2017). *World population trends*. <https://www.unfpa.org/world-population-trends>
- UNFPA. (2021). *World population dashboard*. <https://www.unfpa.org/data/world-population-dashboard>
- Vaske, J. J., Beaman, J., & Sponarski, C. C. (2017). Rethinking internal consistency in Cronbach's alpha. *Leisure Sciences*, 39(2), 163–173. <https://doi.org/10.1080/01490400.2015.1127189>
- Villanen, H. (2014). Teachers' reflections on an education for sustainable development project. *International Research in Geographical and Environmental Education*, 23(2), 179–191. <https://doi.org/10.1080/10382046.2014.908526>
- Weeks, J. R. (2012). *Population: An introduction to concepts and issues*. Cengage Learning.
- Wolff, H., Chong, H., & Auffhammer, M. (2011). Classification, detection and consequences of data error: Evidence from the human development index. *The Economic Journal*, 121(553), 843–870. <https://doi.org/10.1111/j.1468-0297.2010.02408.x>
- World Commission on Environment and Development (WCED). (1987). *Our common future*. Oxford University Press.
- World Wildlife Fund (WWF). (2012). *Türkiye'nin Ekolojik Ayak İzi Raporu* [WWF Turkey Ecological Footprint Reports]. http://awsassets.wwftr.panda.org/downloads/turkiyenin_ekolojik_ayak_izi_raporu.pdf
- WWF. (2014). *Living Planet Report 2014: Species and Spaces, People and Places*. WWF International.
- Yang, G., Lam, C. C., & Wong, N. Y. (2010). Developing an instrument for identifying secondary teachers' beliefs about education for sustainable development in China. *The Journal of Environmental Education*, 41(4), 195–207. <https://doi.org/1080/00958960903479795>

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