Environmental Education and Sustainable Development *Open Access*

Summer (2024) 12(4): 85-99
DOI: 10.30473/ee.2024.69222.2676

ORIGINAL ARTICLE

Comparison of the Effectiveness of Face-to-Face and Virtual Education Using the Comprehensive Citizenship Education Package on Environmental and Sustainable Development Behaviors

Elham Irannezhad[1], Ali Mehdad[2(ORCID: 0000000193665500)], Mohsen Golparvar[3]

1. Ph.D. of Educational Psychology, Department of Psychology, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran
2. Associate Professor, Department of Psychology, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran
3 Professor, Department of Psychology, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran.

Correspondence:
Ali Mehdad
Email: alimahdad.am@gmail.com

Received: 13/Sep/2023
Accepted: 13/Dec/2023

How to cite:
Irannezhad, E., Mehdad, A., & Golparvar, M. (2024). Comparison of the Effectiveness of Face-to-Face and Virtual Education Using the Comprehensive Citizenship Education Package on Environmental and Sustainable Development Behaviors. Quarterly Journal of Environmental Education and Sustainable Development, 12(4), 85-99.
(DOI: 10.30473/ee.2024.69222.2676)

ABSTRACT

Considering the unbreakable links between human behavior, environmental health, and the well-being of all species, education for citizenship behavior, the environment, and sustainable development has emerged as a beacon of hope, leading humanity towards a more harmonious relationship with our planet. This research aimed to compare the effectiveness of face-to-face and virtual education using a comprehensive package of citizenship education on the environmental and sustainable development behaviors of students. The experimental method employed a four-group design, including two test groups (face-to-face and virtual) and two control groups, with a pre-test, post-test, and two-month follow-up design. Among the students of Azad University of Isfahan in the winter and spring of 2023, 25 individuals who met the desired entry criteria were selected for each group and randomly assigned to 4 groups. Citizenship education was implemented using a researcher-made package with a specialized reliability of 0.93, delivered in person for one group and virtually for another group. Data were collected using the Irannezhad et al. (2023) questionnaire. The data were analyzed using repeated measures analysis of variance and Bonferroni's post hoc test in SPSS software version 26. The findings of this research showed that both face-to-face and virtual education were effective in enhancing environmental behaviors and sustainable development. There was no significant difference between the outcomes of the behaviors resulting from the two educational methods.

KEYWORDS

Citizenship, Education, Effectiveness, Environment, Face-to-Face, Sustainable development, Virtual.

آموزش محیط‌زیست و توسعه پایدار

سال دوازدهم، شماره چهارم، تابستان ۱۴۰۳ (۸۵-۹۹)

DOI: 10.30473/ee.2024.69222.2676

«مقاله پژوهشی»

مقایسه اثربخشی آموزش حضوری و مجازی بسته جامع آموزش شهروندی بر رفتارهای شهروندی محیط‌زیستی و توسعه پایدار

الهام ایران‌نژاد[۱]، علی مهداد[۲](ارکید: ۰۰۰۰۰۰۰۱۹۳۶۶۵۵۰۰)، محسن گل‌پرور[۳]

۱. دکتری روانشناسی تربیتی، واحد اصفهان (خوراسگان)، دانشگاه آزاد اسلامی، اصفهان، ایران
۲. دانشیار، گروه روانشناسی، واحد اصفهان (خوراسگان)، دانشگاه آزاد اسلامی، اصفهان، ایران
۳. استاد، گروه روانشناسی، واحد اصفهان (خوراسگان)، دانشگاه آزاد اسلامی، اصفهان، ایران

نویسنده مسئول:
علی مهداد
رایانامه: alimahdad.am@gmail.com

تاریخ پذیرش: ۱۴۰۲/۰۹/۲۲
تاریخ دریافت: ۱۴۰۲/۰۶/۲۲

استناد به این مقاله:
ایران‌نژاد، الهام. مهداد، علی و گل‌پرور، محسن. (۱۴۰۳). مقایسه اثربخشی آموزش حضوری و مجازی بسته جامع آموزش شهروندی بر رفتارهای شهروندی محیط‌زیستی و توسعه پایدار، فصلنامه علمی آموزش محیط‌زیست و توسعه پایدار، ۱۲(۴)، ۸۵-۹۹.
(DOI: 10.30473/ee.2024.69222.2676)

چکیده

با توجه به پیوندهای ناگسستنی بین رفتار انسان، سلامت محیط و رفاه همه گونه‌ها. آموزش رفتار شهروندی محیط‌زیست و توسعه پایدار به‌عنوان چراغ امید ظاهرشده و بشریت را به سمت یک رابطه هماهنگ‌تر با سیاره‌ای که ما خانه می‌نامیم هدایت می‌کند. این پژوهش با هدف مقایسه اثربخشی آموزش حضوری و مجازی بسته جامع آموزش شهروندی بر رفتارهای محیط‌زیستی و توسعه پایدار دانشجویان انجام شد. روش آزمایشی با طرح چهار گروهی، شامل دو گروه آزمایش (حضوری و مجازی) و دو گروه گواه و با طرح پیش‌آزمون، پس‌آزمون و پیگیری دوماهه بود. از میان دانشجویان دانشگاه آزاد اصفهان در زمستان ۱۴۰۱ و بهار ۱۴۰۲ به روش انتخاب نمونه هدفمند، برای هر گروه ۲۵ نفر که معیارهای ورود موردنظر را دارا بودند، گزینش و به‌صورت تصادفی در ۴ گروه جایگزین شد. آموزش شهروندی به کمک بسته محقق ساخته با اعتبار تخصصی ۰/۹۳، به‌صورت حضوری برای یک گروه و به‌صورت مجازی برای گروهی دیگر اجرا شد. برای گردآوری داده‌ها، پرسشنامه ایران‌نژاد و همکاران (۱۴۰۲) به کار رفت. داده‌ها به کمک تحلیل واریانس اندازه‌گیری مکرر و آزمون تعقیبی بونفرونی در نرم‌افزار SPSS نسخه ۲۶ تحلیل شدند. یافته‌های این پژوهش نشان داد، آموزش حضوری و مجازی بر رفتارهای زیست‌محیطی و توسعه پایدار مؤثر بود و باعث افزایش این رفتارها شد. تفاوت معناداری بین پیامدهای رفتارهای حاصل از دو شیوه آموزشی دیده نشد.

واژه‌های کلیدی

اثربخشی، آموزش، توسعه پایدار، حضوری، محیط‌زیستی، شهروندی، مجازی.

Introduction

The world is faced with the intensification of environmental challenges and the urgent need for global cooperation to address these challenges. The ecological landscape of our world is undergoing rapid transformations towards erosion and extinction. Climate change, loss of biodiversity, deforestation, and resource depletion are just a few of the environmental challenges we are facing. These crises extend beyond scientific fields and are intertwined with socio-economic, cultural, and moral dimensions. The complex web of cause and effect emphasizes the inextricable links between human behavior, environmental health, and the well-being of all species. Teaching environmental and sustainable citizenship behavior has emerged as a beacon of hope, leading humanity towards a more harmonious relationship with the planet we call home (Hadjichambis et al., 2020).

Environmental citizenship and sustainable development are related to the rights and responsibilities of the citizens of the earth. Environmental citizenship includes a set of rights (such as the right to a clean climate and the possibility of living) and duties (such as not polluting, Cao, 2018). It is the responsible behavior that people in society perform as agents of change in the private and public spheres on a local, national, and global scale through collective and individual actions to solve contemporary environmental problems and prevent the creation of these problems (Hadjichambis & Hadjichambi, 2019). Environmental citizenship includes exercising environmental rights and duties, as well as identifying the structural causes of environmental degradation and environmental problems, developing the will and competencies for critical and active civic participation to address these structural problems, and individual and collective action in the framework of democracy while considering intragenerational and intergenerational justice (Cao, 2018). Environmental citizenship recognizes the relationship between humans and nature, resulting from emotional, cognitive, and psychological effects, including respect for other living species and wildlife, and behaviors such as gardening, providing water for birds, and thinking about the need to protect other species and promote this idea (Hadjichambis et al., 2020). Pro-environmental behavior includes recycling, saving water, electricity, and reusing, using public transportation, cycling and walking, properly disposing of non-recyclable waste, using fewer materials, and buying and/or consuming green products. Pro-environmental behavior can be influenced by personal beliefs and the behaviors and actions of others. Environmental behavior and people's commitment to the environment are influenced by their mental model and lie in cognitive factors, including environmental value, environmental concern, environmental knowledge, and self-efficacy, which affect people's understanding (Yusliza et al., 2020). Environmental citizenship has a strong relationship with sustainability because it means that the capacity of the joint economic-environmental system is maintained to comply with human needs and desires for a long time. There are environmental limits to economic growth in industrialized societies, and it is claimed that economic growth reduces sustainable poverty and accelerates environmental pressures (showing the need for a balance between economy and ecology). Considering the issues of sustainable development, economic growth should leave much less environmental impact (Hadjichambis et al., 2020).

Sustainable development is a development that meets current needs without compromising the ability of future generations to meet their needs. This concept ensures the right to live in an undisturbed natural environment for generations yet to be born (Faecks et al., 2022). In an era of Earth's history when its shape and conditions have changed under the influence of humans (Lubowiecki-Vikuk et al., 2021), the primary focus of environmental citizenship has been on individual actions such as responsible consumption and minimizing waste. Sustainable citizenship theories have gone beyond individual actions and raised a challenge for the existing socio-economic and political systems (Jaufar, 2021). United Nations member countries set 17 multidimensional goals for sustainable development (Gonçalves,

2022). These goals include three main aspects: community welfare, environmental protection, and economic prosperity (Sedita et al., 2022). The goals of sustainable development cover almost all aspects of life, such as participation and education and discussion about environmental issues (Kovách et al., 2021), attention to nutrition and health (Vermeulen et al., 2020), buying products (Yusliza et al., 2020), consumption management, and pollution reduction (Dean et al., 2016), among many other cases.

In the 21st century, citizenship refers not only to citizens' knowledge of their rights, but also to their willingness to participate independently, so that their decisions and behavior always reflect moral imperatives, social justice, and human dignity. The characteristic of citizenship indicates a bond or relationship that is embodied in the behavior of citizens based on moral obligations (Al-Qatawneh et al., 2019). A good and effective citizen will be a citizen who balances the two sides of right and responsibility. An important point in the field of modern citizenship is that people's understanding of citizenship rights and responsibilities can be different or even opposite, so establishing such a balance requires education (Salimi, 2020). Citizenship education provides opportunities to acquire knowledge and awareness, to have an attitude, and to strengthen abilities that help a person interact effectively with other members of society and participate in life (Fuertes-Camacho et al., 2019). Of course, no person will be considered a citizen by themselves, and one can speak of the existence of a citizen only if the person has become a citizen over time, through formal and informal education (Gisewhite, 2023). Education is an important step in the process of changing people's behavior towards the environment and includes acquiring knowledge about the environment and human system processes; developing skills to understand and deal with environmental issues; educating citizens who are responsible for environmental decisions. The components of environmental literacy include 1) attitude, 2) ecological knowledge, 3) socio-political knowledge, 4) environmental knowledge, 5) cognitive skills, 6) behavioral responsibility towards the environment, and 7) additional determinants of behavioral responsibilities (Nurwaqidah et al., 2019). Environmental education should be conducted to prepare citizens to participate in efforts to create a sustainable environment and increase awareness, responsibility, appreciation, and understanding of the importance of the environment and the impact of human activities on the natural environment. Critical pedagogy can ask questions about whether other species have rights; how such rights are recognized, and whether human intervention in natural processes is moral or not; to raise thinking (Hadjichambis et al., 2020).

Education for sustainability develops the knowledge, skills, values, and worldviews in people to act in ways that contribute to more sustainable patterns of living. Sustainability education is future-oriented and focuses on protecting the environment and creating a fairer environmental and social world through conscious behavior, requiring attention to environmental, social, cultural, and economic systems and interdependence, having future-oriented and value-oriented systemic thinking, discussion, and participation in democratic processes, and exploratory and experimental education (Brett, 2017). 21st century learning requires creativity and innovation, critical thinking and problem-solving, communication and collaboration, and life and work skills to navigate complex life and work environments (Fuertes-Camacho et al., 2019). It seems that citizenship education is a lifelong process, and people need appropriate education throughout their lives (Zuurmond et al., 2023). Citizenship education is not only effective in childhood and youth but also in adulthood (Bonnesen, 2020). University students are an important target audience for citizenship education due to their future roles as citizens and active individuals in the workplace (Telešienė et al., 2021). Considering that anti-citizen behaviors in the field of environment and sustainable development, such as littering, graffiti, smoking in public places, environmental destruction (arson, pouring poison into rivers for the purpose of hunting), and problems such as disregard for the health of others, lack of sense of responsibility and social cooperation,

disregard for the rights of others, roadblocks, excessive consumption of energy and goods (Arayesh & Sheikhi, 2019) are common; and according to the available statistics, waste production in low-income countries is 0.4 to 0.9 kilograms and in middle and high-income countries is 1.1 to 5 kilograms, and this amount is estimated at 0.66 kg in Iran (Firouzjaeian Galougah & Nasiri, 2020); in order to improve the poor state of citizen behavior in the field of environment and sustainable development, it seems very important and necessary to educate people who will soon enter the labor market and take up jobs or raise the next generation.

Research shows that only 43% of people are aware of land rights (Rejekiningsih, 2015). In another study, it was found that the level of knowledge, attitude, skill, and participation of Malaysian youth and teenagers is low in relation to environmental issues, which shows the need for education in this field (Meerah et al., 2010). In Cyprus, the effect of modern education on environmental citizenship was investigated, considering students' past/present environmental citizenship actions, and the findings showed that education significantly increased knowledge, skills, and willingness to act in the future, and environmental citizenship, and was related to the effect of their past/present environmental actions (Hadjichambis et al., 2022). It was found that past environmental actions had a high correlation with learning achievements in current education, which is explained by previous experiences in nature and is positively related to pro-environmental attitudes and behaviors. Education for sustainable development in the era of COVID-19 and in the form of environmental citizenship, and in activities that forced students to think about the difference between the real and virtual worlds, behavior, ethics, and individual values, and have critical thinking, lectures present ideas, play online group games, and read theories; showed that virtual education improves the level of environmental citizenship (Telešienė et al., 2021).

Considering the differences between face-to-face and virtual education and the increasing need to expand the experiences and standards of virtual education, and at the same time, the obvious differences between the face-to-face method, such as the dynamics of the training class and the possibilities of face-to-face response (Paul & Jefferson, 2019) compared to virtual education (Mansoori et al., 2020), it is necessary to carry out such research to reach the necessary experiences and standards for the development and expansion of the approaches and methods of implementing citizenship education. In fact, because in virtual and electronic training and correspondence, verbal and non-verbal signs may not be received (Paul & Jefferson, 2019), therefore, this type of training requires research to clarify and recognize the scientific standards for virtual education in comparison to face-to-face training to help people who prefer to experience learning in a social situation, even if it is accidental and indirect (Mansoori et al., 2020). In addition to the facts mentioned in citizenship education, serious attention should be paid to individual differences, preferences, and attitudes of different groups (Gisewhite, 2023). According to what has been said, the purpose of this article was to investigate whether the effectiveness of face-to-face and virtual education of the comprehensive citizenship education package on environmental and sustainable development citizenship behaviors differ? Or can this package be used to improve the citizenship behaviors of citizens with confidence in its effectiveness?

Research Methodology

This experimental research was with a four-group design, including two experimental groups (including face-to-face and virtual training) and two control groups (one for face-to-face training and the other for virtual training) and with a pre-test, post-test and two-month follow-up design. The statistical population included the students of Isfahan Azad University in the winter and spring of 2024. The sample selection method was convenience sampling. Considering that the sufficiency of the sample size in experimental studies and considering the possibility of attrition is at least 15 to 20 people for each group (Gall et al., 2003); for each group, 25 people were randomly selected among the volunteers who met the entry criteria and replaced in 4 groups. Entry criteria were: Studying at least one academic semester at the Isfahan Azad University; Willingness to

participate in the research and not having acute or chronic psychological problems or disorders (specified by performing a mental health test); and exit criteria were: Absence of two or more in training sessions; simultaneous participation in training related to the field of citizenship. Then, in the first step, a pre-test was taken from all the students. The sustainable development and environment part of the comprehensive package of citizenship education was implemented in five 90-minute sessions in face-to-face and virtual groups. During the research, a number of participants left, and in the final session and post-test stage, 18 and 20 people remained in the face-to-face and virtual groups, respectively. Two months later, the follow-up phase was implemented with the remaining people in the post-test phase who had completed the training sessions. In the follow-up phase, no additional training was provided, and the participants only answered the questionnaire for the previous stages once again.

The tools used in this research were, the citizenship behavior questionnaires by Irannezhad et al. (2023) that had 96 items on a 4-point Likert scale (never=1 to always=4) in 6 sections. The political behaviors section has two subscales including political participation (4 items) and persuasion (2 items); civic behaviors section (7 items); Social behaviors have seven subscales including dealing with others (8 items), considering others (6 items), dealing with differences (3 items), expressing a point of view (3 items), compatibility (4 items), responsible communication (2 items) and critical participation (2 items); The environment and sustainable development behaviors has four subscales of purchase and consumption (8 items), maintenance (6 items), education and conversation (3 items) and nutrition (2 items); The media-related behaviors section has three subscales of awareness of the effect of representation (6 items), critical evaluation (4 items) and participation knowledge (3 items); And the digital citizenship behaviors section has four subscales: ethics and responsibilities (11 items), online participation (8 items), digital literacy (2 items) and learning (2 items). Cronbach's alpha was reported as 0.603, 0.760, 0.862, 0.887, 0.714 and 0.853 for each of the mentioned sections. Its convergent validity was investigated by correlating this questionnaire to various dimensions of Tabesh citizenship, the humanity dimension of moral virtues, and digital bullying questionnaires. The environment and sustainable development section of this questionnaire was used in this research.

The comprehensive citizenship education package was created by Irannejad et al. (2024). This package of educational techniques focused on political, civil, social (10% each), sustainable development (20%), environmental (10%), digital (25%) and media (15%) citizenship behaviors, which is organized in 12, 90 minutes sessions. The first three dimensions each in 1.2 sessions (equal to 108 minutes) and in other respectively in 2.4 (equal to 216 minutes), 1.2 (equal to 108 minutes), 2.5 (equal to 225 minutes), 1.7 (equal to 153 minutes) sessions, training are given. The expert agreement coefficient for this training package was 0.93, which shows the adequacy of this package. In this research, only the part related to environmental and sustainable development education was used. Estimated time for sustainable development and environment training (equal to 324 minutes), along with 50 minutes of taking the test (pre-test and post-test), 40 minutes of introducing the course and stating the goals and rules of participating in the training course and 36 minutes of the final summary was calculated, and training arranged in five 90 minutes sessions.

Table 1. Education on Environmental and Sustainable Development of the Comprehensive Package of Citizenship Education (Irannezhad et al., 2024).

Session	Dimension	Description of the session
1	Sustainable development	1. After the pre-test, group members introduce each other and state the rules and principles governing the group and the course. 2. Getting to know the training framework and the number of training sessions. 3. Emphasizing the importance of confidentiality in creating a safe environment for free discussion and expressing personal beliefs and ideas, and obtaining

Session	Dimension	Description of the session
		confidentiality commitments from members. 4. Starting the sustainable development dimension of citizenship education (The educational technique of caring for our communities and defending a more sustainable future). 5. Giving homework assignments at the end of the session.
2	Sustainable development	1. Students present the sustainable development needs they found in their society and city to the class, and a short discussion is held about them. 2. Continuing the sustainable development education. (The educational technique of identifying needs: recognizing the 17 goals of sustainable development and critically evaluating the needs of society; The educational technique of understanding and recognizing affordable, reliable, sustainable, and modern energy; The educational technique of buying and consuming food: reducing wastage and related costs and its role and importance in the family economy) 3. Giving homework assignments at the end of the session.
3	Sustainable development & environment	1. Examining the requested assignment and a short discussion about the findings and feelings and thoughts created as a result of this exercise. 2. Continuing education after sustainable development of citizenship (The educational technique of promoting inclusive and sustainable industry and strengthening innovation; Educational technique for evaluating water consumption; Ethical lifestyle teaching technique) 3. Start of environmental citizenship education (Ethical lifestyle teaching technique) 4. Ending the meeting and giving homework assignments.
4	Environment	1. Reviewing the requested task and a short discussion about the findings and feelings and thoughts created as a result of this exercise. 2. Continuing the education of the environmental dimension of citizenship (Educational technique of major environmental issues and their importance) 3. Ending the meeting and giving homework assignments.
5	Summary and post-examination	1. Introduction of new participation tools (Use of media and presence in the virtual world for the purposes of sustainable development and environment) 2. Summing up and reviewing what was taught in the entire course. 3. Ending the training and conducting the post-exam.

Analysis method: After collecting the data in three steps of pre-test, post-test and follow-up, to test the research questions, the data related to the three steps using descriptive methods (means, standard deviation and standard error) and inferential (presuppositions check, repeated measurement variance analysis, Bonferroni post hoc test) were done using SPSS version 26 software.

Ethical Considerations: This research is a part of a doctoral dissertation with a code of ethics received from the ethics committee of the Islamic Azad University of Isfahan branch (Khorasgan) under the number: IR.IAU.KHUISF.REC.1401.303.

Research Findings

Table 2 shows the Frequency and frequency percentage of demographic variables of research groups.

Table 2. Frequency and Frequency Percentage of Demographic Variables of Research Groups

Variable and its levels		Experiment (%)		Control (%)		Chi value (*p*)
		Frequency verbal	Frequency Virtual	Frequency verbal	Frequency Virtual	
Age	18-24	14 (77.8)	18 (90)	16 (88.8)	19 (95)	3.303 (0.636=*P*)
	25-29	1 (5.5)	0	1 (5.6)	0	
	30>&	3 (16.7)	2 (10)	1 (5.6)	1 (5)	
Sex	Woman	16 (88.8)	16 (80)	15 (83.3)	14 (70)	2.283 (0.516=*P*)
	Man	2 (11.2)	4 (20)	3 (16.7)	6 (30)	
Marriage	Single	15 (83.3)	19 (95)	16 (88.8)	19 (95)	2.122

Variable and its levels		Experiment (%)		Control (%)		Chi value (*p*)
		Frequency verbal	Frequency Virtual	Frequency verbal	Frequency Virtual	
	Married	3 (16.7)	1 (5)	2 (11.2)	1 (5)	(0.547=*P*)
Have a job?	Yes	10 (55.6)	11 (55)	11 (61.1)	14 (70)	1.196 (0.745=*P*)
	No	8 (44.4)	9 (45)	7 (38.9)	6 (30)	
Does mother work?	Yes	3 (16.7)	3 (15)	4 (22.2)	1 (5)	2.398 (0.494=*P*)
	no	15 (83.3)	17 (85)	14 (77.8)	19 (95)	
Economic situation	Low	5 (27.8)	4 (20)	3 (16.7)	3 (15)	2.189 (0.902=*P*)
	Middle	8 (44.4)	10 (50)	8 (44.4)	12 (60)	
	High	5 (27.8)	6 (30)	7 (38.9)	5 (25)	

As can be seen in the last column of Table 2, the chi-square test was not significant for any of the variables, which indicates that the frequency distribution of the demographic variables of the participants among four research groups, there is no significant difference (P<0.005). In Table 3, the data from the Shapiro-Wilk test (normality of variables distribution), the data from Levin's test (equal variance of the groups), the equality of the variance-covariance matrix, and the Mauchly equality Sphericity test is presented for environmental and sustainable development behaviors variable and its sub-scales.

Table 3. The Data of Shapiro-Wilk, Levin, M-Box and Mackley Test in Environmental Citizenship and Sustainable Development Variable and Their Sub-scales

Scale	Test	Shapiro-Wilk		Levin test		Mbox (P value)	Mauchly (*P* value)
		Statistic	*P* value	Statistic	*P* value		
Maintenance	Pre-test	0.966	0.039	0.064	0.979	106.947 (0.000)	0.167 (0.000)
	Post-test	0.911	0.000	5.268	0.002		
	Follow up	0.898	0.000	7.980	0.000		
Education and discussion	Pre-test	0.921	0.000	0.410	0.746	113.628 (0.000)	0.696
	Post-test	0.924	0.000	5.027	0.003		
	Follow up	0.892	0.000	12.626	0.000		
Purchase and consumption	Pre-test	0.902	0.000	0.086	0.967	160.587 (0.000)	0.282
	Post-test	0.900	0.000	5.307	0.002		
	Follow up	0.912	0.000	2.941	0.039		
Food	Pre-test	0.937	0.001	0.313	0.816	41.825 (0.003)	0.718
	Post-test	0.875	0.000	4.464	0.006		
	Follow up	0.906	0.000	2.626	0.057		
Total citizenship	Pre-test	0.954	0.000	0.166	0.919	133.402 (0.000)	0.159
	Post-test	0.946	0.000	4.284	0.008		
	Follow up	0.950	0.000	3.632	0.017		

As can be seen in Table 3, in all three stages of the test, in the sub-scales of maintenance, education and discussion, purchase and consumption, and food and environmental and sustainable development citizenship behaviors in total, data distribution was not normal (p< 0.01); only in the pre-test phase, the equality of error variance (p< 0.05) was established. Also, as can be seen in Table 3, Mauchly's test was not established for the subscales of maintenance, education and conversation, purchase and consumption, food and total (p < 0.01). This means that the assumption of sphericity has not been observed for these variables. In cases where the assumption of sphericity is not met, the Greenhouse-Geisser

statistic can be used in the final analysis tables. In Table 4, the mean and standard deviation of the pre-test, post-test, and follow-up stages of environmental and sustainable development variables and their sub-scales in the research groups are presented.

Table 4. The Mean and Standard Deviation of Environmental Citizenship and Sustainable Development Variable and Their Sub-Scales in Research Groups in Three-Time Stages

Scale	Time	Verbal edu.		Virtual edu.		Verbal control		Virtual control	Virtual control
		Average	St.div.	Average	St.div.	Average	St.div.	Average	St.div.
Maintenance	Pre-test	18.389	3.415	18.100	5.167	18.778	2.922	18.600	3.016
	Post-t.	22.611	1.577	22.050	5.111	18.778	2.861	18.600	2.741
	Foll.up	22.778	1.396	22.350	5.111	18.889	2.698	18.900	2.553
Education and discussion	Pre-test	7.668	1.495	7.750	56.56	7.722	1.526	7.700	1.302
	Post-t.	9.944	1.260	11.650	56.167	7.778	1.517	7.850	1.182
	Foll.up	10.500	0.924	11.950	56.611	8.167	1.618	7.950	1.136
Purchase and consumption	Pre-test	24.444	4.003	24.500	5.167	24.389	3.600	24.250	3.796
	Post-t.	29.222	1.555	29.100	5.111	24.500	3.434	24.350	3.483
	Foll.up	28.778	1.865	28.950	5.111	24.444	3.535	24.350	3.483
Food	Pre-test	5.000	1.455	5.000	1.451	5.167	1.200	5.150	1.349
	Post-t.	6.889	0.676	6.950	0.686	5.111	0.963	5.150	1.137
	Foll.up	6.500	0.923	6.450	0.944	5.111	0.834	5.150	1.268
Total citizenship	Pre-test	55.500	8.692	55.350	8.035	56.56	6.699	55.700	7.463
	Post-t.	68.667	3.819	69.750	3.462	56.167	6.336	55.950	6.565
	Foll.up	68.556	3.714	69.700	3.840	56.611	6.288	56.350	6.588

As can be seen in Table 4, in the total and its sub-scales, in the training groups (face-to-face and virtual) there were more changes in the post-test and follow-up phase than the control group. The data of repeated measurements variance analysis for environmental and sustainable development citizenship behaviors and its subscales are presented in Table 5.

Table 5. Repeated Measurement Variance Analysis data for Environmental Citizenship and Sustainable Development and Their Subscales.

Scale	Source		Sum of squares	Df	Mean of squares	F	*P* value	Etha	Power
Maintenance	Within Group	Time	235.987	1.091	216.316	113.087	0.000	0.611	1.000
		Time*Group	212.690	3.273	64.987	33.974	0.000	0.586	1.000
		Error(time)	150.248	78.547	1.913	-	-	-	-
	Between Group	Group	302.022	3	100.674	5.662	0.002	0.191	0.935
		Error (group)	1280.119	72	17.779	-	-	-	-
Education and discussion	Within Group	Time	161.484	1.534	105.296	343.575	0.000	0.827	1.000
		Time*Group	138.326	4.601	30.065	98.101	0.000	0803	1.000
		Error(time)	33.841	110.421	0.306	-	-	-	-
	Between Group	Group	279.571	3	93.190	22.533	0.000	0.484	1.000
		Error (group)	297.776	72	4.136	-	-	-	-
Purchase and consumption	Within Group	Time	272.010	1.164	233.589	132.591	0.000	0.648	1.000
		Time*Group	251.626	3.493	72.28	40.885	0.000	0.630	1.000
		Error(time)	147.707	83.843	1.762	-	-	-	-
	Between Group	Group	556.359	3	185.453	6.660	0.000	0.217	0.967
		Error (group)	2004.781	72	27.844	-	-	-	-
Food	Within Group	Time	37.076	1.560	23.772	80.613	0.000	0.528	1.000
		Time*Group	39.613	4.679	8.466	28.710	0.000	0.545	1.000
		Error(time)	33.115	112.297	0.295	-	-	-	-
	Between Group	Group	56.017	3	18.672	5.776	0.001	0.194	0.940
		Error (group)	232.769	72	3.233	-	-	-	-
Total citizenship	Within Group	Time	2524.774	1.086	2324.484	269.005	0.000	0.789	1.000
		Time*Group	2280.755	3.258	699.944	81.002	0.000	0.771	1.000

Scale	Source		Sum of squares	Df	Mean of squares	F	*P* value	Etha	Power
		Error(time)	675.763	78.204	8.641	-	-	-	-
	Between	Group	4108.616	3	1369.539	12.898	0.000	0.350	1.000
	Group	Error (group)	7645.104	72	106.182	-	-	-	-

As seen in Table 5, there was a significant difference (p<0.01) in the time factor between the four research groups in the within-group effect section for the maintenance subscale (F=113.087, df=1/091), education and discussion (F=343/575, df=1/534), purchase and consumption (F=132/591, df=1/164), food (F=80/613, df=1.560) and total (F=269.005, df=1.086) and also in the interaction of time and group for the maintenance subscale (F=33.974, 3.273 df), education and discussion (F=98/101, df=4/601), purchase and consumption (F=40/885, df=4/731), food (F=28/710, df=4/679) and total (F=81.002, df=3.258).

The eta square parameter for the time factor in the maintenance subscale is equal to 0.611 and for the time interaction factor with the group is equal to 0.586 and the power of the test in both factors is equal to 1. This finding shows that for the time factor and the interaction of time and group, respectively, 61.1 and 58.6 percent of the difference in maintenance is related to the application of the independent variable (one of the teaching methods in the research), which with 100 percent power Confirmed. The parametric eta square for the time factor in the education and discussion subscale is equal to 0.827 and for the time interaction factor with the group is equal to 0.803 and the power of the test is equal to 1 for both. This means that for the time factor 82.7 and for the interaction of time and group 80.3 percent of the difference is related to the application of the independent variable, which has been confirmed with 100 percent power. The eta square for the factor of time for shopping and consumption is equal to 0.648 and for the interaction factor of time with the group is 0.630 and the power of the test is equal to 1 for both. This finding shows that for the time factor, 8.64, and for the interaction of time and group, 63% of the difference was related to the application of the independent variable, which was confirmed with 100% power.

The squared coefficient of eta for the time factor, respectively, for the subscale of nutrition and the total behavior of environmental citizenship and sustainable development, equal to 0.528 and 0.789, and the power of the test is equal to 1, and for the interaction factor of time with the group, respectively, is equal to 0.545. And 0.771 and the power of the test is equal to 1. This finding shows that for the time factor, 52.8, 78.9, and 54.5, 77.1 percent of the difference in the aforementioned variables, respectively, and for the interaction of time and group, respectively, is related to the application of the independent variable, which with 100 The power percentage is confirmed.

Also, as can be seen in Table 5 in the between group effect section, for maintenance subscales (F=5.662), education and discussion (F=22.533), purchase and consumption (F=6.660), food (F=5.776) and total (F=12.898), there is a significant difference between groups (df=3, p<0.01). Due to the significance of the interaction between time and group in environmental and sustainable development variables and its sub-scales, Bonferroni's follow-up test was performed to investigate the possible difference between the experimental and control groups, which is shown in Table 6.

Table 6. Data of Bonferroni's Follow-up Test for a Two-by-two Comparison of Research Groups in Environmental Citizenship and Sustainable Development

Scale	Base group	Compare group	Compare group	Standard Error	*P* value	Base group	Compare group	Min difference	Standard Error	*P* value
Maintenance	Pre t	Post	**-2.043	0.187	0.000	e.verbal	e.virtual	0.426	0.791	1.000
	Pre t	foll t	**-2.262	0.211	0.000	e.verbal	e. control	*2.444	0.811	0.021
	post	follow	**-0.219	0.055	0.001	v. virtual	v. control	*2.133	0.770	0.043

Scale	Base group	Compare group	Compare group	Standard Error	*P* value	Base group	Compare group	Min difference	Standard Error	*P* value
Education and discussion	Pre t	Post	**1.596	0.073	0.000	e.verbal	e.virtual	*-1.080	0.381	0.036
	Pre t	foll t	**-1.532	0.098	0.000	e.verbal	e. control	**1.481	0.391	0.002
	post	follow	**-0.336	0.062	0.000	v. virtual	v. control	**2.617	0.371	0.000
Purchase and consumption	Pre t	Post	**-2.397	0.207	0.000	e.verbal	e.virtual	-0.035	0.990	1.000
	Pre t	foll t	**-2.235	0.183	0.000	e.verbal	e. control	*3.037	1.016	0.023
	post	follow	0.162	0.069	0.063	v. virtual	v. control	**3.200	0.963	0.008
Food	Pre t	Post	**-0.946	0.093	0.000	e.verbal	e.virtual	-0.004	0.337	1.000
	Pre t	foll t	**-0.724	0.079	0.000	e.verbal	e. control	*1.000	0.346	0.031
	post	follow	**0.222	0.056	0.001	v. virtual	v. control	*0.983	0.328	0.024
Total citizenship	Pre t	Post	**-6.982	0.424	0.000	e.verbal	e.virtual	-0.693	1.933	1.000
	Pre t	foll t	**-7.153	0.426	0.000	e.verbal	e. control	**7.963	1.983	0.001
	post	follow	-0.171	0.101	0.288	v. virtual	v. control	**8.933	1.881	0.000

As seen in Table 6, There is a significant difference between all three stages of the test in the sub-scales of maintenance, education discussion, and food ($p<0.01$). There is a significant difference ($p<0.01$) between the pre-test and post-test and pre-test and follow-up stages in the purchase and consumption subscale and total. However, the difference between the post-test and follow-up stages is not significant ($p>0.05$). Also, in the comparison between the research groups, there is no significant difference between the two training groups in terms of maintenance, food, purchase, and consumption ($p>0.05$). However, there is a significant difference between each training group and the control group ($p<0.05$). This means that both face-to-face and virtual training have improved the behaviors of environmental and sustainable development citizenship. In the subscale of education and discussion, virtual training is more effective than face-to-face training. Also, in all subscales, both training groups have obtained higher scores than the related control group, and this difference is significant ($p< 0.01$ or $p< 0.05$).

Conclusion

As seen in the findings section, there was a significant difference between all three stages of the test in the sub-scales of maintenance, education and discussion, and nutrition. There was a significant difference between the pre-test and post-test and pre-test and follow-up stages in the purchase and consumption sub-scale and the total, but the difference between the post-test and follow-up stages was not significant. There was a significant difference between each training group and its corresponding control group. This means that both face-to-face and virtual training have improved environmental and sustainable development citizenship behaviors. In the sub-scale of education and discussion, virtual training was more effective than face-to-face training. Also, in all the subscales, both training groups obtained higher scores than the related control group, and this difference was significant.

In the food subscale, the effectiveness of face-to-face and virtual training was almost the same. The follow-up showed a significant decrease in behavior compared to the post-test. Although there is still a significant difference with the pre-test, the behavior seen in the post-test phase has decreased significantly after two months. In explaining this finding, it can be said that food behaviors occur in the culture of

family and friends and are mostly cultural. Even if a person has the right desire and attitude, they may not be able to stand for it in the opposite environment. In line with this explanation, Vermeulen et al. (2020) stated that changing diets is relatively difficult in three aspects: What we eat is an independent individual or small group choice; it is based on experience and there are few levers to change behavior at the community level. Finally, even where there is awareness and desire to eat healthier and more sustainably, practical challenges, such as the unavailability of options, or psychological problems, such as procrastination, lack of will, habit or forgetfulness, and biased or automatic decision-making processes, can create a barrier to change. People tend to resist familiar things and the existing situation, as well as options that are socially considered normative.

In the follow-up phase of maintenance and education and discussion sub-scales, there was a significant and increasing difference, meaning that the improvement of citizenship behaviors in these fields continued. Also, regarding the reason for the difference in the effectiveness of virtual training on education and discussion behaviors, it is possible that the group who volunteered for virtual training was more active in the online world, and after completing the course, they shared what they had learned and discussed it more online. In the real world, there are fewer opportunities for education or discussion, or it is more difficult to access a group with a common interest. In the research of Kovách et al. (2021), it was found that the knowledge of activation, participation and persuasion (education and discussion) is clearly a strength and superiority in environmental citizenship education.

In Dean et al.'s research (2016), it was seen that very active people had the highest level of knowledge and the strongest environmental identity in the family, and they tried to conserve water and reduce pollution in their homes. Also, social norms have a strong influence on environmental behaviors and support for water policies. Descriptive norms (others save water) and supportive norms (others want us to save water) affect participation. Expressing social norms can reduce household energy and water consumption and increase support for environmental policies. The findings of Yusliza et al. (2020) also showed that environmental awareness has an important effect on pro-environmental behaviors. Environmental awareness is closely related to green shopping behavior, consumption of pro-environmental products and participation in projects to increase environmental sustainability. The behavior that emerges as a result of awareness remains stable. As a result, it remains high in the follow-up phase.

In line with the general findings of this research, in the research of Hadjichambis et al. (2022), education in the field of sustainability and environment increased students' competencies and environmental citizenship behavior. Also, Nurwaqidah et al. (2019) found that schools that have environmental education in their program provide an experience related to the environment, a positive effect on knowledge, attitudes and willingness to act responsibly towards the environment and thus affect the improvement of environmental literacy. Fuertes-Camacho et al. (2019) concluded that education for sustainable development, in an integrated approach that includes knowledge, procedures, attitudes, and values in project-oriented and team assignments, increases sustainability-related competencies. Rejekiningsih (2015) found in their research that only 43% of people are aware of land rights and citizenship education to strengthen the principles of the social practice of land rights in the moral dimension of citizenship and to create the ability to act in improving environmental behaviors. It was effective.

In this study, in general, virtual and face-to-face training did not show a significant difference in improving citizenship behaviors. Gisewhite (2023) investigated the possibility of using internet tools in psychological research, comparing web-based assessment techniques with traditional paper-based methods considering different criteria (internet attitudes and behaviors). No difference was found in the psychometric properties of online and paper questionnaires. These findings showed that web-based data collection is not statistically different from traditional methods and can be a

suitable alternative to more traditional paper-based methods.

Also, Telešienė et al.'s research (2021) implemented sustainable development education in the form of environmental-ecological citizenship in the era of Corona virtually, and it was found that virtual education improved the level of environmental citizenship. The results of Paul and Jefferson's (2019) research also showed a potential for using online education to teach the main concepts of environmental science and citizenship. Since citizenship education is more about presenting knowledge in the form of a systemic and critical look at issues, awareness of what or how to do things, and knowledge about the effects of different activities or different choices, whether in the real or virtual world, it seems that this knowledge can be increased both face-to-face or virtually to such an extent that the citizens consciously participate in the issues and problems of society and take action.

The limitations of this research include the implementation of this research in the student community, which should be considered. In this research, the difference in citizenship behaviors across social strata (gender, education, economic and social class) was not investigated. The questionnaire is a self-report and so it was not determined whether it was reflected in their actual behavior or not.

It is suggested that this research be repeated on people from other social groups to determine its effectiveness on different strata. Investigating the difference in citizen behavior in different strata will help to find different needs in each stratum and incorporate them in the educational program, and it is suggested that an investigation be conducted on it. In another research, apart from the individual's report of their performance, the desired citizenship behaviors should be observed and the actual behavior of individuals should be compared with their reports.

REFERENCES

Al-Qatawneh, S.S., Alsalhi, N.R., Eltahir, E. (2019). "*The Citizenship Values included in intermediate stage Arabic-language textbook and teachers' awareness of them in the UAE": A case study*. Heliyon 5: 1-11. doi: 10.1016/j.heliyon.2019.e02809.

Arayesh, M. and Sheikhi, M.T. (2019). "Investigating the relationship between citizenship education and sustainable urban development (case study: Ardabil city)". *Sosiological Studies*, 10(34): 33-60. [In Persian] https://urb.dehaghan.iau.ir/article_674868.html?lang=en

Bahrami, V., Tag, A., & Amiri, H. (2017). "The Analysis of the Effective Factors on Citizenship Knowledge among Students (Case Study: City of Poldokhtar)". *Social Development & Welfare Planning*, *8*(31), 81-116. doi: 10.22054/qjsd.2017.8250 [In Persian]

Bonnesen, L. (2020). "Children's lived citizenship learning processes: Impact of a voluntary approach". *Children and Youth Services Review*, 110:1-11. https://doi.org/10.1016/j.childyouth.2020.104807

Brett, P. (2017). "*Making Connections between Civics and Citizenship and Education for Sustainability*". In book: Peterson, A., and Tudball, L. (Eds). Civics and Citizenship Education in Australia: Challenges, Practices and International Perspectives, Chp: 10, pp.165-185. Publisher: Bloomsbury Publishing: Sydney. Retrieved from: 10.5040/9781474248228.ch-011.

Cao, B. (2018, Mar-Feb). "Defining Environmental Citizenship". *1st European Joint Meeting*, 28 Feb-2 Mar 2018, Lemessos, Cyprus. https://enec-cost.eu/wp-content/uploads/2018/06/Keynote-Presentation-by-Dr-Benito-Cao-The-University-of-Adelaide-Australia-Defining-Environmental-Citizenship.pdf

Dean, J. A. Lindsay, J., Fielding, S. K., & Smith, D.G. L. (2016). "Fostering water sensitive citizenship – Community profiles of engagement in water-related issues". *Environmental Science & Policy, 55*: 238–247. https://doi.org/10.1016/j.envsci.2015.10.016

Faecks, B., Smits, M., & Möller, I. (2022). "*The Evolution of Sustainable Development in the Voluntary Carbon Market".* MSc Thesis. Environmental Policy Group. Washington

University.

Firouzjaeian Galougah, A.A. and Nasiri, S. **(**2020**).** **"**Pathological analysis of environmental pollution with emphasizing on littering in university campus (case study: students of Mazandaran University)". *Environmental Sciences*. 18(2): 31-150. [In Persian]. https://doi.org/10.29252/envs.18.2.131

Fuertes-Camacho, M.T., Graell-Martín, M., Fuentes-Loss, M., Balaguer-Fàbregas, M.C. (2019). "Integrating Sustainability into Higher Education Curricula through the Project Method, a Global Learning Strategy". *Sustainability,* 11*,* 767. https://doi.org/10.3390/su11030767

Gall, M. D., Borg, W. R., & Gall, J. P. (2003). '*Educational Research: An Introduction'*. (7th ed.). New York: Longman, Inc.

Gisewhite, R.A. (2023). "A whale of a time: engaging in a war of values for youth activism in science education". *Cult Stud of Sci Educ*. https://doi.org/10.1007/s11422-022-10140-5

Gonçalves, H. (2022). "Welfare-Partnership Dynamics and Sustainable Development". *Sustainability, 14*, 7819. https://doi.org/10.3390/su14137819

Hadjichambis, A., Hadjichambi, P. D. (2019, nov). "Environmental Citizenship Questionnaire (ECQ)–Insights from a Cyprus study". *1st Conference of International Researchers of the Education for Environmental Citizenship,* Malaga, Spain.

Hadjichambis, Ch., A., Paraskeva-Hadjichambi, D. R. P., Činčera, J., Boeve-de Pauw, J., Gericke, N., Knippels, M.K. (Eds.). (2020). "*Conceptualizing Environmental Citizenship for 21st Century Education"*. Springer. Witzerland. 264 P.

Irannezhad, E., Mehdad, A., & Golparvar, M. (2023). "Constructing and validating a collection of citizenship behavior questionnaires for students". *Strategic Research on Social Problems in Iran*, in press. [In Persian]. Doi:10.22108/SRSPI.2023.137899.1909

Irannezhad, E., Mehdad, A., & Golparvar, M. (2024). "Developing a comprehensive package of citizenship education based on the new dimensions of this phenomenon: a qualitative study". *Social Psychology Research*, 13(52). in press. [In Persian].

Jaufar, S. (2021). "Shaping of sustainable citizenship among young people of Kulhudhuffushi, Maldives and Hamilton, New Zealand: context, conditions and experiences". *Sustainable Earth*, *4*(1): 1-12. doi.org/10.1186/s42055-020-00040-3

Kovách, I., Megyesi, G. B., Barthes, A., Oral, V. H., and Smederevac-Lalic, M. (2021). "Knowledge Use in Education for Environmental Citizenship—Results of Four Case Studies in Europe (France, Hungary, Serbia, Turkey)". *Sustainability*, *13*(19). 11118; https://doi.org/10.3390/su131911118

Lubowiecki-Vikuk, A., Dabrowska, A. & Machnik, A. (2021). "Responsible consumer and lifestyle: Sustainability insights". *Sustainable Production and Consumption, 25*, 91–101. DOI:10.1016/j.spc.2020.08.007

Mansoori, S., Salarikohfini, Z., and Ghasemali, M. (2020). "A Comprison Between the Effectiveness of E-learning and Blended Learning in Industrial Training". *Interdiscip J Virtual Learn Med Sci,* 11(1): 46-53.

Meerah, M. S. T., Halim, L. and Nedson, T. (2010). "Environmental citizenship: What level of knowledge, attitude, skill and participation the student awn?" *Procedia Social and Behavioral Sciences, 2*: 5715-5719.

Nurwaqidah, S., Suciati, S. N. & Ramli, M. (2019). "Environmental Literacy Mapping Based on Adiwiyata and Non Adiwiyata at Junior High School in Ponorogo", in The First International Conference on Education, Science and Training: Empowering Educational Human Resources for Global Competitiveness, *Social Sciences*, pages 179–190. DOI 10.18502/kss. v3i15.4365

Paul, J., and Jefferson, F. (2019). "A Comparative Analysis of Student Performance in an Online vs. Face-to-Face Environmental Science Course from 2009 to 2016. Original Research", *Front. Comput. Sci*. 1:7-16. doi.org/10.3389/fcomp.2019.00007

Rejekiningsih, T. (2015). Law Awareness Forming Strategies to Reinforce the Principles of Social Function of Land Rights within the Moral Dimension of Citizenship, Procedia - *Social and Behavioral Sciences*, 211, 69-74, https://doi.org/10.1016/j.sbspro.2015.11.011.

Salimi, J. (2020). A Study of "Citizenship Education" on the Curriculum: Research

Synthesis of the Relative Studies in two Recent Decades. *Jcr. Shirazu*, 9(2), 255-287. https://jcr.shirazu.ac.ir/article_5535.html

Sedita, R. S., Blasi, S., and Yang, J. (2022). "The cultural dimensions of sustainable development: A cross-country configurational analysis". *Sustainable Development*, 30(6), 1-12. https://doi.org/10.1002/sd.2351

Telešienė, A., Pauw, B. J., Goldman, D. and Hansmann, R. (2021). "Evaluating an Educational Intervention Designed to Foster Environmental Citizenship among Undergraduate University Students". *Sustainability* 13(15): 8219. https://doi.org/10.3390/su13158219

Vermeulen, S.J., Park, T., Khoury, C.K. and Béné, C. (2020). "Changing diets and the transformation of the global food system". *Ann. N.Y. Acad. Sci., 1478*: 3-17. https://doi.org/10.1111/nyas.14446

Yusliza, Y. M., Amirudin, A., Rahadi, A. R., Athirah, N.S. N.A, Ramayah, T., Muhammad, Z., Dal Mas, F., Massaro, M., Saputra, J., and Mokhlis, K.S. (2020). "An Investigation of Pro-Environmental Behaviour and Sustainable Development in Malaysia". *Sustainability, 12*: 7083. Retrieved from: doi: 10.3390/su12177083.

Zuurmond, A., Guérin, L., vanderPloeg, P. & vanRiet, D. (2023). "Learning to question the status quo. Critical thinking, citizenship education and Bildung in vocational education". *Journal of Vocational Education & Training*, 20. DOI: 10.1080/13636820.2023.2166573