

Can primary school pupils become researchers? A research project on the accessibility of public spaces

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ABSTRACT

Education for sustainable development plays an important role in the cognitive and social development of pupils. A wealth of studies demonstrate the correlation between environmental education (EE) projects and the future potential development of informed and active citizens with pro-environmental behaviours. All EE projects have common characteristics, but usually the pupils involved in them hold the position of little explorers. It would be interesting if students could have the role of the researcher and be actively involved in all stages of a research project. The current study aims to describe a research on the accessibility of public space and to contribute to the discussion if primary school pupils could become researchers. The main conclusion of this paper, after the evaluation of the research project, is that pupils from the upper primary school classes can play an active role in a scientific research project.

Keywords: research project, accessibility, primary education, education for sustainable development

INTRODUCTION

The United Nations adopted the 17 sustainable development goals (SDGs) in 2015. Within the framework of SDGs, participatory action is proposed at the global level to protect the environment and ensure peace and prosperity for all people by 2030. SDGs integrate social, economic and environmental sustainability into the development of every society and attempt to embed the concept of active citizenship and inclusive development. It is noted that there is a consideration as to whether the goals will be fully achieved eventually (Gupta & Vegelin, 2016) or whether the economic growth will be a frontline priority, which will negatively impact achieving sustainability and ecological integrity (Eisenmenger et al., 2020; Luetz & Walid, 2019). At this point it should also be noted the suggestion that, given that SDGs have been built on the foundations of economic development, there is a need for a redefinition of education for sustainable development (ESD) based on the values and principles of ecological integrity (Kopnina & Bedford, 2024).

However, the need to develop the social responsibility of individuals, the achievement of which is necessary to meet SDGs, and the contribution of formal, non-formal and informal education in the process of promoting sustainable development is highlighted (Walid & Luetz, 2018). Essentially, ESD has its roots in environmental education (EE) and focuses on the interdependence of the economic, social, ecological and

political aspects of the environmental problems. EE is being transformed into an education through which active citizens can understand the causes of environmental issues and act (Henderson & Tilbury, 2004). The development of positive environmental attitudes and behaviors is a complex process, determined by various external and internal factors (Abeliotis et al., 2010; Ajzen 1991; Grob, 1995; Stern, 2000), so ESD projects should not be a simple transfer of knowledge. The main characteristics of innovative projects should include differentiated, experiential and student-centered methodological approaches, the promotion of learning and discovery in an interdisciplinary way and the motivation of students to become actively involved in educational practice. In this way, metacognitive skills will be developed, such as critical and creative thinking, interpretation and inference (Slavich & Zimbardo, 2012).

Given that ESD should be a continuous learning process in which students will understand their environment, form attitudes and values and acquire knowledge and skills to be able to solve environmental problems (Vaughan et al., 2003), the 17 SDGs are now negotiated in innovative school curricula. Within the framework of 17 SDGs it is possible to carry out several educational research projects. A goal within which students' learning motivation and interest in active participation and action in the community could be developed and enhanced through a scientific research project is the 11th SDG "sustainable cities and communities". The 11th SDG

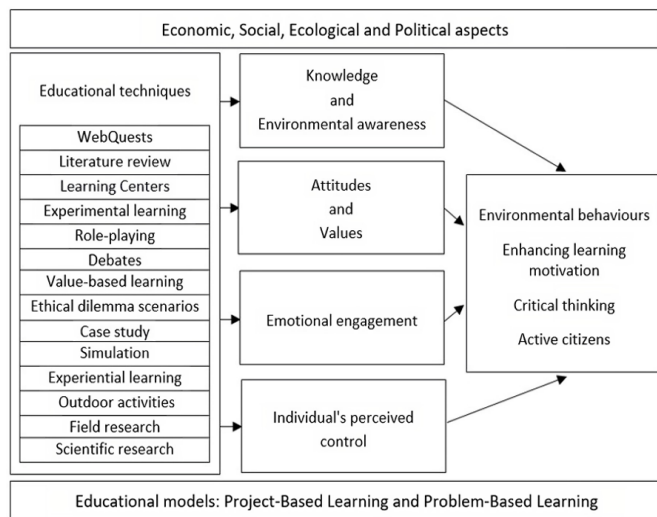


Figure 1. Learning model in ESD on Grob's (1995) model of environmental behavior

emphasizes inclusive access to public spaces for all, particularly children, older people and people with disabilities. Pupils can explore the accessibility of public spaces in their city, formulate their thoughts and act on how to remove restrictions on the free and inclusive movement of citizens and visitors in the city, where they live. The term accessibility implies the absence of barriers to movement. Accessibility is the ability of a person to have independent access to some point in the city (Rodrigue et al., 2006). This term differs from the term mobility, which assesses the ability of individuals to move (Miller, 2018).

It is well documented that a qualitative EE project can have a positive impact on students' environmental outcomes such as environmental attitudes, intentions, behavior and knowledge (Ardoin & Bowers, 2020; Bergman, 2016; van de Wetering et al., 2022). Within the educational environment, the possibility of action through experiential learning becomes particularly important for understanding and perceiving the complexity of environmental and social issues at the global level (Fuertes-Camacho et al., 2019). The educational models of project-based learning and problem-based learning (PBL) incorporate the four learning principles that are crucial for ESD projects: constructive learning, collaborative learning, contextual learning and self-directed learning (Cörvers et al., 2016). Depending on the objectives set, there is a variety of educational techniques associated with effective ESD projects that can be used. Some of these, within an overall proposed scheme for the learning model in ESD, based on Grob's (1995) model of environmental behavior, are illustrated in **Figure 1**. Learner-centered, critical thinking and participatory decision making are some the main characteristics of these techniques (Ichinose, 2017).

In Greece, teachers are expressing their interest in EE and are implementing various projects, despite significant deficiencies in the development of teachers' environmental skills and in the structure of the educational policy framework for ESD (Petkou et al., 2021). Unfortunately, these barriers, and in particular the second one, have led to a restriction of the EE in schools (Ntona et al., 2023), both in primary and secondary education. The most frequently used educational techniques at secondary education are field exercise, experiment,

simulation and role-playing (Koutsoukos et al., 2015). In primary education, the majority of projects incorporate pedagogical practices that are age-appropriate for pupils and have been mentioned in Ardoin and Bowers' (2020) systematic review of the research literature, such as visiting a natural area, gardening, creating artwork, action taking such as recycling and tree planting, and developing knowledge. We can therefore argue that scientific research is not a preferred educational technique in Greece. There is strong evidence, particularly for high school students, of their participation in research projects in science courses (Burgin et al., 2012; Neber & Anton, 2008; Reiss et al., 2023) but not for ESD projects. Therefore, it was considered interesting to examine whether upper primary school students can play an active role in a scientific investigative research project. By this, we mean the involvement of students undertaking original research, with strictly defined steps, such as formulating questions, constructing methodological tools for data collection, statistically processing and interpreting the data and, finally, drawing conclusions and recommendations. Active involvement of the students is considered necessary especially in PBL framework. PBL promotes critical thinking and problem-solving in authentic learning situations (Yew & Goh, 2016) and research project is an appropriate method for the investigation of a problematic situation. In the context of innovative projects and through the lens of ESD, particular attention should be paid to the process of designing and implementing scientific research projects involving primary school pupils and to the way in which the foundations can be laid for creating future responsible and active citizens.

Given the above, present study aims to describe a research project on the accessibility of public space and to contribute to the discussion if primary school pupils could become researchers. The research project was conducted by sixth grade primary school pupils under the guidance and support of their teacher, in the context of the 11th SDG. It was an educational research with scientific criteria, which aimed to investigate the accessibility infrastructure of pupils' community. For this reason, the research was called CERE project, the initials of words community engagement, research, and education.

MATERIALS & METHODS

CERE project by pupils of the 6th grade (10-11 years old) of a primary school in Maroussi, a northern suburb of Athens in Greece, lasted seven months: from September 2019 to March 2020. PBL was considered the most appropriate methodology for integrating the research project. Pupils played an active role in all steps of problem-solving like defining the problem, designing and implementing the research, analyzing the data, interpreting the findings, searching for solutions, promoting the most appropriate solution and evaluating the research project.

Grob's (1995) model adopted as the most appropriate conceptual framework for developing pro-environmental behaviors. In this model, emotional engagement and perceived control, the belief that individual actions can have an impact, are considered as critical components. In order to increase pupils' emotional engagement and perceived behavioral

control, cooperative and experiential learning, outdoor activities, survey were chosen as teaching methods. The class teacher had an advisory and supportive role. He guided and advised the teams, encouraged the pupils' efforts and coordinated the feedback breaks.

At first, the environmental teams were formed. The problem that motivated further research was the difficulty of wheelchair and pushchair access to school, a real problem that all pupils were aware of. Then the objectives and evaluation indicators of the project were defined. The survey was conducted in November 2019. For the purposes of the survey, the pupils prepared a questionnaire with the support of the class teacher. The questions/statements were related to the accessibility of the public spaces of the Municipality of Maroussi, especially for people with disabilities. The respondents were asked to indicate on a five-point Likert scale in nine statements their positive-to-negative strength of agreement (two positive and two negative) regarding the questions, while they were also given a neutral/undecided (N/U) option. In three questions they could choose between "yes", "no" and "N/U". The questions/statements are presented in tables. In addition, in the questionnaire, respondents recorded their age and whether they are residents or visitors to the Municipality of Maroussi. The final questionnaire contained 14 questions/statements and it could be divided into two subscales: the accessibility difficulties faced by all people and the barriers faced by people with disabilities. The internal consistency of the questionnaire statements was assessed by class teacher based on the reliability coefficient (Cronbach's alpha), using the statistical package for the social sciences (SPSS version 21.0). Cronbach's alpha was found to be 0.71 in the present study, a value, which is within acceptable range (Tavakol & Dennick, 2011).

A Google Form questionnaire was used to collect research data. The link of this Google Form questionnaire was mailed to school community and posted on the school's website. The 231 persons (n=231, 71.4% residents and 28.6% visitors) who responded the questionnaire were the sample size for the present study. The age range of respondents was from 18 to 60 years old.

Statistical analysis of the data was performed using descriptive statistical indicators, absolute and relative frequencies by the pupils' environmental teams. This statistical analysis corresponds to the cognitive level of pupils in this age group and the mathematical skills they are expected to develop. At this point, it is important to underline that the pupils had previous knowledge and experience with statistical analysis and related software. The classroom teacher had previously taught these concepts in mathematics class and the computer science teacher had already taught the pupils to record data, to calculate related frequencies and to construct bar charts using a spreadsheet program as part of the math and computer curricula for 6th grade pupils. The pupils worked in groups and carried out the statistical analysis initially without the use of any software. They also constructed the tables of results and prepared the respective bar charts using colored cardboard. Then, the environmental teams repeated in the school's computer laboratory the statistical analysis using spreadsheet software program and they compared their first results.

The next stage of the research project was the outdoor activity in February 2020. The environmental teams were involved in field research in order to record the main difficulties in accessibility of public spaces in the city, in a specific part of the city center, near the school. They used cameras to photograph everything that was relevant to the needs of the research in order to document their results. In order to extract the observations from the photographic material the method of content analysis was used. Content analysis is a flexible methodological technique that can be used with a wide variety of data sources, such as textual, photo/video and audio data, either empirically or theoretically (Stemler, 2015).

The final stage of the research was to record the conclusions and proposals for improving the current situation. The original intention was for the environmental teams to present the results at a city council meeting. However, due to the restrictions imposed by the COVID-19 pandemic, this was not possible. Instead, the school principal announced the results to city council members via teleconference. At the end, the pupils and the class teacher completed the evaluation of the whole research project.

RESULTS

Table 1 presents the descriptive statistics (absolute and relative frequencies) of the survey on the accessibility of public spaces in the Municipality of Maroussi. **Table 2** presents the descriptive statistics (absolute and relative frequencies) of the survey on the accessibility of people with disabilities.

Table 1. Descriptive statistics on accessibility of public spaces in Municipality of Maroussi

Questions/statements & responses	n (%)		
	Residents (n=165)	Visitors (n=66)	All subjects (n=231)
Experience with barriers/restrictions in public space			
Strongly disagree	3 (1.8)	0 (0.0)	3 (1.3)
Disagree	27 (16.4)	9 (13.6)	36 (15.6)
N/U	30 (18.2)	24 (36.4)	54 (23.4)
Agree	63 (38.2)	12 (18.2)	75 (32.5)
Strongly agree	42 (25.5)	21 (31.8)	63 (27.3)
Experience with physical barriers/constraints on sidewalks			
Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)
Disagree	0 (0.0)	9 (13.6)	9 (3.9)
N/U	3 (1.8)	12 (18.2)	15 (6.5)
Agree	69 (41.8)	9 (13.6)	78 (33.8)
Strongly agree	93 (56.4)	36 (54.5)	129 (55.8)
Difficulties in accessing schools			
Strongly disagree	3 (1.8)	0 (0.0)	3 (1.3)
Disagree	9 (5.5)	12 (18.2)	21 (9.1)
N/U	54 (32.7)	21 (31.8)	75 (32.5)
Agree	66 (40.0)	24 (36.4)	90 (39.0)
Strongly agree	33 (20.0)	9 (13.6)	42 (18.2)
Lack of crossings on main streets			
Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)
Disagree	15 (9.1)	15 (22.7)	30 (13.0)
N/U	18 (10.9)	9 (13.6)	27 (11.7)
Agree	81 (49.1)	21 (31.8)	102 (44.2)
Strongly agree	51 (30.9)	21 (31.8)	72 (31.2)

Table 1 (continued). Descriptive statistics on accessibility of public spaces in Municipality of Maroussi

Questions/statements & responses	n (%)		
	Residents (n=165)	Visitors (n=66)	All subjects (n=231)
Unsafe crossings of parents/guardians with pushchairs on main streets & sidewalks			
Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)
Disagree	6 (3.6)	0 (0.0)	6 (2.6)
N/U	18 (10.9)	12 (18.2)	30 (13.0)
Agree	57 (34.5)	27 (40.9)	84 (36.4)
Strongly agree	84 (50.9)	27 (40.9)	111 (48.1)
Public spaces of Maroussi are accessible for all (overall accessibility)			
Strongly disagree	39 (23.6)	9 (13.6)	48 (20.8)
Disagree	60 (36.4)	24 (36.4)	84 (36.4)
N/U	54 (32.7)	24 (36.4)	78 (33.8)
Agree	12 (7.3)	9 (13.6)	21 (9.1)
Strongly agree	0 (0.0)	0 (0.0)	0 (0.0)

Table 2. Descriptive statistics on accessibility of public spaces in Municipality of Maroussi of people with disabilities

Questions/statements & responses	n (%)		
	Residents (n=165)	Visitors (n=66)	All subjects (n=231)
Difficulties in accessing sidewalks by people with disabilities			
Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)
Disagree	0 (0.0)	0 (0.0)	0 (0.0)
N/U	0 (0.0)	9 (13.6)	9 (3.9)
Agree	48 (29.1)	15 (22.7)	63 (27.3)
Strongly agree	117 (70.9)	42 (63.6)	159 (68.8)
Lack of crossings for people with disabilities			
Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)
Disagree	6 (3.6)	3 (4.5)	9 (3.9)
N/U	18 (10.9)	15 (22.7)	33 (14.3)
Agree	36 (21.8)	21 (31.8)	57 (24.7)
Strongly agree	105 (63.6)	27 (40.9)	132 (57.1)
Lack of wheelchair access ramp in public space			
Yes	12 (7.3)	21 (31.8)	33 (14.3)
N/U	51 (30.9)	18 (27.3)	69 (29.9)
No	102 (61.8)	27 (40.9)	129 (55.8)
Poor maintenance of wheelchair access ramp			
Yes	111 (67.3)	30 (45.5)	141 (61.0)
N/U	51 (30.9)	30 (45.5)	81 (35.1)
No	3 (1.8)	6 (9.1)	9 (3.9)
Non-accessible services/activities for people with disabilities			
Yes	57 (34.5)	30 (45.5)	75 (32.5)
N/U	102 (61.8)	30 (45.5)	144 (62.3)
No	6 (3.6)	6 (9.1)	12 (5.2)
Maroussi is a city friendly for people with disabilities & mobility difficulties			
Strongly disagree	87 (52.7)	12 (18.2)	99 (42.9)
Disagree	57 (34.5)	39 (59.1)	96 (41.6)
N/U	18 (10.9)	15 (22.7)	33 (14.3)
Agree	3 (1.8)	0 (0.0)	3 (1.3)
Strongly agree	0 (0.0)	0 (0.0)	0 (0.0)

The majority of respondents consider that public spaces of Maroussi are not accessible for all (55.2%). Residents and visitors are experienced with barriers/restrictions in public space (59.8%). The situation becomes worse when respondents report their experiences of crossing sidewalks: almost nine out of 10 agree/strongly agree that are experienced with physical

barriers or constraints on sidewalk, such as parked vehicles, small width, litter, trees and road signs.

Difficulties in accessing public schools due to poor sidewalks conditions were recorded by respondents (57.2%). 75.4% strongly agree/agree on the lack of crossings on main streets, which can affect the safety of pedestrians during their crossing. An even higher percentage of respondents (84.5%) mentioned as unsafe the access to main streets and sidewalks in the City of Maroussi by parents/guardians with pushchairs. The vast majority of the sample (84.5%) believes that Maroussi is not a friendly city for people with disabilities and mobility difficulties, since it lacks the necessary infrastructure. 55.8% report that there are public spaces, where there is a lack of wheelchair access ramp. Even where they exist, their poor condition and lack of maintenance is reported (61.0%). Almost all respondents (96.1%) consider that people with disabilities have difficulties in accessing the city's sidewalks. A very high percentage of respondents also consider that lack of crossings on main roads affects the mobility of people with disabilities (81.8%).

Finally, 32.5% of sample report that there are services or activities in city that, although people with disabilities would like to participate in, this is not possible due to a lack of infrastructure.

In relation to the content analysis of the photographic evidence, the following points are noted. At first, the photographic material was coded. Then, it was studied and classified according to its content. The three categories that were extracted from the analysis were "sidewalks", "road crossings" and "wheelchair access ramps". It should be noted that the third category included photographs, which showed public buildings or infrastructure, where the absence of wheelchair access ramps was evident. Finally, the content was analyzed by student groups and the results of the study were recorded. **Table 3** summarizes the main access difficulties recorded during the field research. The pupils' environmental teams documented with photographic evidence the difficulties that make accessibility prohibitive for people with mobility difficulties/disabilities and compromise the safe mobility of pedestrians and parents/guardians with pushchairs.

DISCUSSION & CONCLUSIONS

The purpose of this paper was to present a research conducted by sixth grade primary school pupils during the implementation of a school research project on ESD in the framework of the 11th SDG "sustainable cities and communities" and to record the main conclusions that emerged from the statistical analysis and evaluation of the project. The discussion will be divided into two levels, the results of the pupils' research and the outcomes of the evaluation of the research project.

Based on the results from the survey, the overall situation in the Municipality of Maroussi with regard to the accessibility of the public spaces of the city is characterized as moderate, since very often the lack of crossings, the poor condition of the sidewalks, their inappropriate width and all kinds of obstacles, such as parked vehicles, make it difficult to access them freely. This becomes particularly obvious and dangerous for parents

Table 3. Summary of main access difficulties in Municipality of Maroussi

Sidewalks	Road crossings	Wheelchair access ramps
Poor maintenance	Absence in public spaces	Poor maintenance
Inappropriate/small width	Inability to cross due to parked cars	Absence in public spaces
Inability to access due to parked cars or other obstacles (e.g., litter, trees, signs, café tables, & chairs)	Road crossings leading to high kerbs & not in access ramps	Inability to access due to parked cars
Absence or poor maintenance of tactile paving for people with visual impairment		

or guardians with pushchairs. For people with disabilities, such as people using wheelchairs and people with visual difficulties, accessing/passing public spaces is very often characterized as difficult or even prohibitive due to lack of infrastructure and interfering obstacles. It is therefore clear that these people cannot safely and autonomously move around public spaces and services offered by the Municipality of Maroussi. The results of the quantitative research are strengthened by the field research evidence and the qualitative data collected by the environmental teams. Main results of field research were

- (a) the inability of people with disabilities to have equal access to public spaces, since they face multiple difficulties when moving around in public spaces and sidewalks in the city and
- (b) the lack of social responsibility of some people who park their vehicles without caring about the free and safe passage of others, mainly children, people with pushchairs, elderly people and people with disabilities.

Accessibility is a fundamental right that should be protected but this does not seem to be supported by the results of this research. Accessibility for people with disabilities remains a problem for the City of Maroussi. Therefore, improving the state of accessibility in public spaces and existing infrastructure through a total accessibility plan in public spaces, infrastructure and services of the community is an urgent need, not only for people with disabilities but also for all residents and visitors of the city. This particular survey designed and developed in the frame of an innovative school project in primary education, can only be characterized as indicative of the situation in the Municipality of Maroussi. Strong limitations of this research are the small sample size of the survey, the limited city space in which the pupils moved during the fieldwork and the statistical analysis, which was conducted. However, given that in Greece, there have been no similar surveys by primary school pupils and considering their mathematical skills in data analysis, we can argue that the strength of this paper is the presentation of an integrated research project with scientific criteria, which highlights a major issue such as the accessibility of public spaces. Also, through the collection, processing and analysis of quantitative data and field research, an attempt was made to help pupils establish the concept of active citizen by exploring the accessibility infrastructure in their city.

The survey and the results were posted on the school's website for dissemination to the school community. As mentioned above, the school principal announced the results to the community. The city council took note of the results of the survey. A few months later the Municipality of Maroussi started work to improve the existing situation in selected areas in the city center. This gave the pupils of the research teams the understanding that, even at this young age, they can play

an active role in their community and contribute to improving the infrastructure of their city. Although not within the aims of this study, it is worth noting that in relation to the overall evaluation of the project, student outcomes were consistent with the findings of Ardoin and Bowers (2020). What was recorded was development of pupils' environmental literacy and their cognitive, social, and emotional development. Analysis of the survey data led to the strengthening of their mathematical and computer science skills. This finding is reflected in the quantitative assessments of the statistical analysis unit for sixth grade. Based on their grades as reported in the pupils' files, in this unit, the average assessment of the pupils was 0.8 points higher than the average of their assessments in the other units for mathematics and 0.3 points higher for computer science. Active participation in all steps of the research project led to the development of their social and emotional development. Dissemination of the results reinforced pupils' belief that their actions were effective and increased their perceived control. These aspects seemed to have a positive impact on creating and enhancing motivation for learning. In order to assess children's motivation before (pre-test) and after research project (post-test), the Greek version of the Academic Motivation Self-Rating Inventory was used (Entwistle, 1968; Kakavoulis, 1984). Pupils were asked to answer 19 questions (Vassiloudis & Chalda, 2024) and the answers was used to determine the pupil's motivation index, which can range from zero to 24. To answer the questionnaire, pupils used an individual numerical code given by the teacher, which was common for the pre- and post-test. The analysis conducted by class teacher using SPSS 21.0 showed that the mean for all pupils of the post-test (15.82) was higher than the pre-test (12.84) and the means of both the pre- and post-tests differed significantly ($p < 0.01$). Pupils also seemed to establish positive attitudes towards the environment and people with disabilities. These findings are recorded with caution since they were based on the unstructured systematic real-time silent observation based on teacher assessment. Pupils had the opportunity, in a constructive learning environment, to explore as active citizens a problematic situation that is part of their everyday life. They were also able to propose solutions in order to improve existing infrastructure of their community with the ultimate goal of achieving an inclusive society.

If we accept the claim that research projects may be used in an attempt to reflect aspects of science more authentically than other learning approaches (Reiss et al., 2023), we can argue that it is possible for upper primary school pupils to be involved as researchers in a scientific research project with positives learning outcomes. Teachers should have in mind that if a learner becomes engaged by an activity, he is responding in a creative way (Kenny, 1993).

In conclusion, the design and implementation of innovative ESD projects and the active participation of pupils, in the context of a continuous educational intervention, could have long-term positive results, developing pupils' social responsibility, so that they become active and responsible citizens in the future.

Further studies in this field are required to confirm the findings of this work.

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Declaration of interest: No conflict of interest is declared by the author.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the author.

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