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Impact of active learner involvement in a contextual and relevant environmental education programme on learning effectiveness

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ABSTRACT
This research aimed, among other things, to reveal the methods used and the pedagogical approaches preferred by teachers to address courses related to the environment and environmental education. We targeted teachers from three subjects: Life and Earth Sciences (LES), History-Geography (HG), and Islamic Education (IE). One of the research objectives is to characterise the impact of adopting active approaches combined with the contextualisation of environmental education on the acquisition of environmental knowledge and on the development of the willingness to adopt pro-environmental behaviours. To achieve this objective, we conducted a pedagogical intervention within the school's environmental club (Club created by the teachers). The data collection tool consisted of two questionnaires; the first was addressed to a sample of 362 teachers, and the second was intended for a sample of 60 learners (30 learners representing the experimental group, and 30 learners forming the control group). We adopted a descriptive correlational design for the part concerning teachers and a quasi-experimental design for the section reserved for learners. The results allowed us to confirm that the active engagement of learners in contextual, relevant and motivating environmental education programs leads to a significant improvement in the acquisition of environmental knowledge, as well as the development of willingness to act in favour of the environment and adopt pro-environmental behaviours.

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Introduction

Environmental education (EE) is an integral aspect of the development of individuals and social groups, which relates to their relationship to the environment (El Batri, 2020). It aims to develop useful knowledge, practical skills and behaviours imbued with environmental ethics. This allows acting individually and collectively in favour of the environment (Baysura & Alcı, 2024). EE is a field of reflection and interdisciplinary action par excellence. It allows the integration of various types of interdisciplinary cognitive resources (Affolter & Varga, 2018; Tan & So, 2019).

A pedagogical approach is a way of understanding the different elements involved - the learner, the content, the teacher, and the relationships between them, such as through the organisation of communication, the teaching/learning environment, etc.) through strategies, predetermined methods, and techniques to form a coherent system" (El Batri, 2020b). Within a particular framework of EE, we can distinguish two typologies of approaches: one relating to the learning object and the other relates to the learning process (EL Batri et al., 2022).

Concerning the approaches relating to the learning object, EL Batri et al., 2022 and Fraser et al., 2015 distinguished the following approaches: cognitive, affective, spiritual (religious) , moral, behaviourist, pragmatic and praxis. For the approaches relating to the learning process, these same authors specified the following approaches: experiential, systemic, holistic, interdisciplinary, cooperative, critical and problem-based approach (problem-solving pedagogy). It should be noted that these approaches are not mutually exclusive. In fact, they are complementary. The behaviourist approach, for instance, aims to instil specific behaviours that promote environmental protection through positive or negative reinforcement. The problem-solving approach engages learners in identifying and analysing real environmental issues, encouraging them to develop well-informed and appropriate solutions. Both approaches can be combined to maximise their impact on environmental education.

In the literature, we find a plurality of definitions of the term 'pedagogical method', but almost all converge towards the same meaning, being It's the process that leads to the goal set. In other words, it is the set of activities and procedures organised by the teacher that guides the learner to achieve well-defined objectives. Generally, teaching methods are classified into two large groups: traditional transmissive methods and active methods (El Batri et al., 2019a; Freeman et al., 2014).

The so-called traditional methods are essentially centred on the transmission of knowledge and the authority of the teacher. The latter mainly uses a vertical dialogue in the form of question/ answer, or presents and explains the lesson with an almost total passivity of the learner. Evaluation is essentially based on memorisation and repetition of the same content. For example, the dogmatic method and the interrogative method (El Batri et al., 2019a).

Active learning is generally defined as any teaching method that engages learners in the learning process (El Batri, 2020b; Ülger and Çepni, 2020). This type of learning requires learners to engage with meaningful learning activities and think about what they are doing. The key element of this type of learning is the active involvement of the learner. Active learning is among the best pedagogical practices that enhance learners' performance, according to several researchers (Bram, 2016; Freeman et al., 2014; Wallace et al., 2021).

Among the active learning methods widely studied and recognised as having a positive effect on student outcomes, we can cite working in small groups (Johnson, D. W., & Johnson, R. T., 2018; Gillies et al., 2023; UNESCO, 2017 and others), based on problem solving (Jonassen & Hung, 2015; Loyens et al., 2015). Problem-based learning is often associated with another active method, which is discovery learning (Abrahamson & Kapur, 2018; Hanafi, 2016). Discovery learning can be defined as an educational method that encourages pupils to learn through their own exploration, experience and research. Learning generally involves identifying a problem, developing, and testing hypotheses, to draw a conclusion (Collins & O'Brien, 2011, p. 160). In this process, the teacher is a facilitator rather than an instructor. Its role is to organise a rich appropriately resourced learning environment and to

encourage the learner's self-directed curiosity and problem-solving skills 'guided discovery', rather than demonstrating or providing "correct" answers (Wallace, 2015).

Other active learning methods can be found in the literature, including the dialogue method (Karakaş, 2022: Muhonen et al., 2016). It was introduced by Paulo Freire, in which teachers engage learners in discussions to understand their perceptions and experiences (Collins & O'Brien, 2011). Dialogue teaching harnesses the power of speech to stimulate and develop learner thinking, learning, and understanding (Muhonen et al., 2016). The demonstrative method (Bouchut, 2022; Ekeyi, 2013) refers to the type of teaching method in which the teacher is the main actor while the learners observe with the intention of acting later. Here, the teacher does everything the learners are supposed to do at the end of the lesson (demonstration) by showing them how to do it and explaining the process step by step (Quoted by Ekeyi, 2013).

The area of EE is largely influenced by active learning methods. This is why we find more or less the same methods recommended in EE (El Batri et al., 2019a; Genc, 2015; Özalemdar, 2021). This is to improve knowledge, values, attitudes and behaviour towards the environment. Genc (2015) stressed that active learning methods must be implemented to achieve effective EE. Other researchers (Boeve-de Pauw & Van Petegem, 2018; El Batri et al., 2019a) have reported that teaching methods that encourage more active learner engagement improve environmental attitudes and conceptual understanding. In addition to the methods already mentioned, studies in EE stress the importance of visits and field trips on the cognitive, emotional, physical and ethical level (El Batri et al., 2019a, 2019b, 2020a; Lee et al., 2020; Saribas et al., 2017; Sothmann & Menzel, 2017). Pro-environmental behaviour refers to actions and practices that contribute to the protection and preservation of the environment. These behaviours can range from individual actions, such as recycling and conserving energy, to collective efforts, such as participating in environmental advocacy or community clean-up projects.

In addition to the impact of active learner engagement, it is very important to contextualise environmental knowledge and activities. Contextualisation in education is a pedagogical action that involves linking science to society and to the learner's local environment (Kitheka, 2024; Latip & Kadarohman, 2024; Parker & Roumell, 2020; Zimmerman & Weible, 2017). It is an operationalisation and concretisation of broad and ambiguous scientific concepts. It is another aspect of didactic transposition that aims to make scientific knowledge more meaningful for the learner. Some authors have expressed this contextualisation by referring to "the local approach" (Villemagne, 2005, p. 338). According to El Batri (2020b), this approach is based on anchoring educational activities in the learners' living environment and the socio-ecological issues that characterise it. Several authors have emphasised the positive impact of addressing local and tangible environmental issues on improving learning outcomes and the learner's pro-environmental behaviour (Chanse et al., 2017; Higde et al., 2017; Saribas, Kucuk & Ertepinar, 2017; Sauvé, 2014; Tugurian & Carrier, 2017 and others). These studies, along with many others on environmental education and learning psychology, support the idea that contextualising environmental education, combined with active learner engagement, generally leads to a significant improvement in the acquisition of environmental knowledge and the development of a willingness to adopt pro-environmental behaviours.

In addition, to instil original, relevant and effective environmental education, we have utilised certain Islamic principles. It is well known in many communities that religious influence runs deep in people's lives and sometimes determines the type of relationship an individual can have with oneself, with others, and with the environment. Some environmental education specialists (Athayde, 2017; Avis, 2021; Kim et al., 2017; Parker, 2017) advocate for the consideration of religion and indigenous cultures in environmental education programmes. Among the Islamic principles that can be utilised within the framework of environmental education, we can mention the following:

- Principle of shared vital resources

Islam considers essential environmental resources for life, such as water, to be shared among all people, and no one is allowed to exclusively appropriate such resources and deprive others of them (Surah Al-Qamar (the Moon), verse 28).

- Man as a responsible steward of the environment, not an absolute owner

In the Islamic perspective, man is not the absolute owner of his environment, and he is not allowed to do whatever he wants, even with what he possesses. Indeed, he is considered a steward (caliph), meaning a responsible manager who should properly manage and utilize his possessions, without causing harm or wastefulness (Surah Al-A'raf, verse 56; Surah Al-Baqarah (the Cow), verse 205).

• Principle of moderation and prohibition of waste

Islam highly praises those who adopt the principle of moderation in the consumption of resources. Several verses and Hadiths recommend that consumption should be reasonable (the middle path), avoiding any waste and excess. This values God's gifts on one hand and prevents falling into deficiencies and shortages on the other hand, ensuring sustainable consumption.

• Principle of environmental preservation and prohibition of pollution

Islam highly values the preservation of the environment and prohibits any irresponsible harm to the lives of beings, whether human, animal, or plant.

• The call to clear and cultivate the land for the benefit of humanity and living beings.

Many Quranic verses and Hadiths of the Prophet (PBUH) encourage Muslims to clear and cultivate the land for their own benefit and for the benefit of all living beings.

Research Questions

This study aims to answer three research questions:

1) What are the methods and the pedagogical approaches used by teachers to tackle courses in environmental education?
2) Are there significant correlations between the adoption of behavioural and/or problem-solving approaches and the development of pro-environmental behaviours?
3) Does the contextualisation of environmental education combined with active learner engagement lead to a significant improvement in the acquisition of environmental knowledge and the development of the willingness to adopt pro-environmental behaviours?

The uniqueness of this study lies in considering the local context in its environmental and socio-cultural dimensions. In the literature, we did not find similar studies that address these two dimensions of contextualisation together. This action research was not limited to making the learner aware of the specificities of their local environment and identifying its main issues. Indeed, the activities of the environmental club promoted active learner engagement and participation in solving certain local environmental problems.

Methods

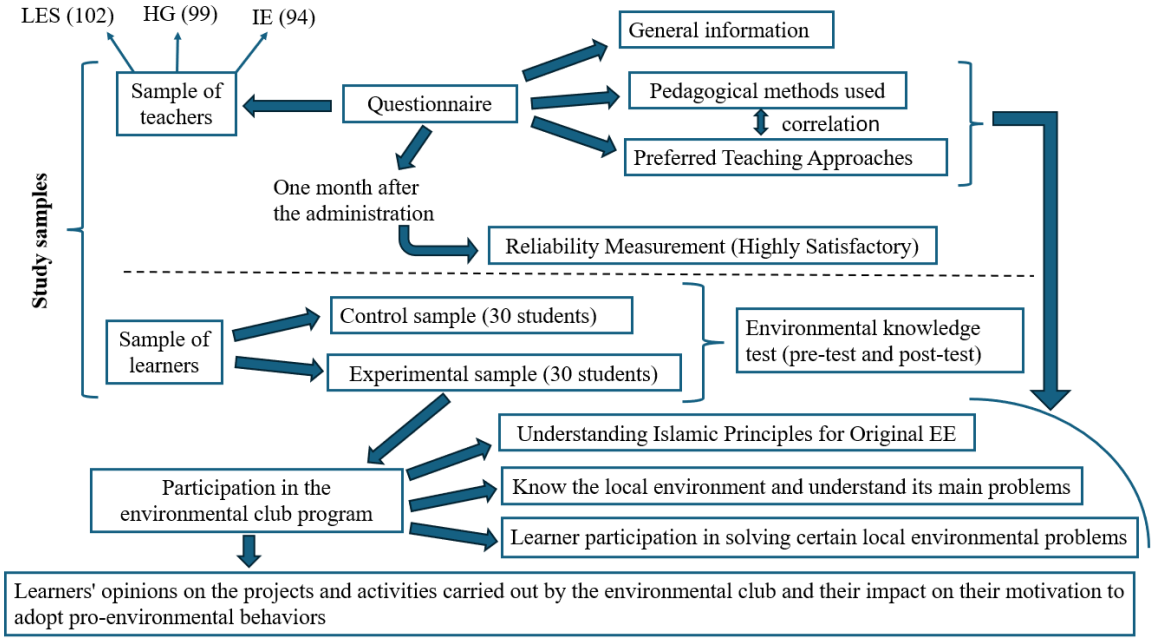
Research Design

For this research, we adopted a quasi-experimental design. This design is often used to measure the impact of implementing a programme or an educational intervention (Güvenir & Türkmen, 2024; Karpudewan & Mohd Ali Khan, 2017; Miller, Smith & Pugatch, 2020). In the field of education, when testing the effect of a pedagogical intervention, it is not possible to perfectly control all the other variables that may come into play. Additionally, there is a lack of random assignment. In this case, we rather speak of a 'quasi-experimental' design (Falk & Heckman, 2009).

Figure 1 presents a general summary diagram of the entire methodological process adopted in this research.

Figure 1

General diagram of the methodological process



Samples

Sample of teachers

We used stratified sampling to represent both urban and rural areas. This is because we have taken into account the significant educational differences between the two environments which have been revealed by previous studies (CSEFRS, 2018; El Batri et al., 2019a, 2019b, 2020a). The sample of teachers concerns middle school teachers of three subjects: Life and Earth Sciences (LES), History-Geography (HG) and Islamic Education (IE). Indeed, the syllabi of these three subjects contain units relating to the environment and environmental education (EE). The "LES" particularly with its units relating to ecology, and the "HG" convey the notions of environmental education through certain units relating to geography and citizenship education. And finally, the "IE" syllabus with the unit entitled "environmental education" taught in the 3 years of middle school. All teachers interviewed belong to the Regional Academy of Fez-Meknes. With the aim of obtaining valid results from a representative sample, we collected exhaustive samples from the Fez Directorate (urban) and the Moulay Yacoub Directorate (rural). Table 1 shows quantitative data on the sample of teachers selected.

Table 1

Sample of teachers

Environment	LES			HG			IE			Total $N_1+N_2+N_3$
	N total teachers	Sample N_1	%	N total teachers	Sample N_2	%	N total teachers	Sample N_3	%	
Urban	112	102	91	160	99	62	145	94	65	295 (70%)
Rural	26	23	88	27	23	85	25	21	84	67 (86%)
Total	138	125	91	187	122	65	170	115	68	362 (73%)

Note that some teachers did not indicate their gender in the questionnaire. We mentioned them in the genre table as well (no answer). Tables 2 and 3 respectively represent gender / subject and gender / environment cross tables. LES is taught mostly by female teachers (Table 2). Table 3 shows that female teachers represent 61% in urban areas and only 45% in rural areas.

Table 2

Teacher gender /subject cross-tabulation*

		Subject			Total
		IE	HG	LES	
Gender of the Teacher	No answer	9	7	6	22
	Male teachers	50	61	34	145
	Female teachers	56	54	85	195
	Total	115	122	125	362

Table 3

*Environment * teacher gender cross-tabulation*

		Gender of the Teacher			Total
		No answer	Male teachers	Female teachers	
Environment	Urban	21	109	165	295
	Rural	1	36	30	67
Total		22	145	195	362

Sample of Learners

To participate in the environmental club projects, we randomly selected pupil members (15 boys and 15 girls) from many students who expressed their willingness to join the club. The selected pupils represent leaders in their classes (two per class, one boy and one girl) in terms of environmental awareness. They may not necessarily be the top-performing pupils in their classes. They participate in the management of the club with the teachers and coordinate between the club and their classes. However, the environmental club is open and everyone can participate in certain activities offered. To measure the impact of our intervention within the environmental club, we randomly selected another class of 30 as a control group. Table 4 summarises the data from both samples.

Table 4

Sample of Learners

	Boys	Girls	Total
Experimental Sample (Environmental Club Members)	15	15	30
Control Sample	17	13	30
Total	32	28	60

Data Collection Tool

The tool used to collect data from teachers was a three-part questionnaire. The first part was reserved for general information concerning the teachers taking part in the study - their age, gender, establishment, municipality and delegation. The second part of the questionnaire is an exploration of the different methods used by teachers of the three subjects (IE, HG and LES) to deal with the units relating to the environment in their programmes. We defined the different methods that could be used (12 items) and the teachers were invited to tick the appropriate box according to their degree of use of each method. We used the four-point scale. 0 points were awarded to "Not used", 1 to "Rarely", 2 to "Occasionally" and 3 points to "Often". The percentages of teachers have been counted for each subject separately. However, each teacher can claim to have used more than one method. Note that these same methods have been mentioned in other studies (El Batri et al., 2019a).

Table 5

Extract of the teaching methods proposed to teachers

1) The teacher explains the lesson and the students listen without participation (dogmatic).
2) Partial participation of students by answering some questions asked by the teacher (interrogative method).
3) Dialogue method with active participation of students at all stages of the lesson.
4) Group work method for performing works and assignments either inside or outside the classroom.
5) Realization of laboratory experiments.
6) Performing school outings to supplement and support environmental knowledge.

The third part of the questionnaire aimed at teachers explores the different pedagogical approaches preferred by teachers to tackle courses related to the environment and environmental education. We used approaches adapted to EE as proposed by Agusalim and Karim (2024); Bloom and Fuentes (2019); Miseliunaite et al. (2022); Rechberger, (2024); Walshe, (2017) and others. The five-point Likert scale identified the level of agreement or disagreement of teachers for each type of approach. We assigned 0 points to “Strongly disagree”, 1 to “Disagree”, 2 to “Indifferent”, 3 to “Somewhat agree” and 4 points to “Strongly agree”. It should be noted that the teacher can respond favourably or unfavourably to several types of approaches, especially since certain approaches are more or less correlated with each other.

Table 6

Extract from the proposed teaching approaches

1) The cognitive approach: it aims to transmit to learners a set of environmental knowledge.
2) The religious approach: centred on the development of attitudes and values consistent with a religion.
3) The behaviourist approach: aims to instil an appropriate behaviour with respect to the environment.
4) The experiential approach aims at direct contact with real situations, the realisation of experiences and interaction with the living environment to develop handling skills, on the one hand, and, on the other hand, to understand natural phenomena.
5) The holistic approach: takes into account all the dimensions of the subject and allows the development of a global vision of socio-environmental and educational realities.
6) The systemic approach: takes into account the networks of interrelations and interdependencies within the environment (ecosystems).
7) The interdisciplinary approach: integrates knowledge from different disciplines for better understanding and informed action.

Regarding the validity of the tool used, in addition to our professional experience as a teacher of LES, we explored the literature to look for the different teaching methods and approaches likely to be used in courses relating to the environment as well than EE. The methods that we have proposed to have been validated and already used in other studies (El Batri et al., 2019a). The pedagogical approaches appropriate to the EA that we have proposed to have been mentioned in several other studies (Bloom and Fuentes, 2019; Miseliunaite et al., 2022; Rechberger, 2024; Walshe, 2017). The responses collected giving a very small proportion to the items "other methods" and "other approaches" show that the main methods and pedagogical approaches are indeed those that we have proposed.

One month after the end of data collection, we carried out a post-test with 12 teachers who were chosen at random from the teachers already interviewed. The responses which were similar to those collected during the first data collection were of the order of 92% as an average percentage. This indicates that the reliability of the instrument is very satisfactory. The reliability index (Cronbach's alpha) applied to the questionnaire components gave 0.695 for the approaches and 0.714 for the teaching methods. This shows that the internal consistency of the instrument is satisfactory.

In addition to the questionnaire addressed to teachers regarding preferred approaches and methods, we formulated another questionnaire, this time for the pupil members of the environmental club. In this questionnaire, we sought the opinions of the pupils regarding the projects and activities carried out by the club and their impact on their relationship with the environment. In addition to the questionnaires, we conducted an environmental knowledge test for both the experimental and control groups. This test aimed to measure the impact of the implemented projects on the acquisition of environmental knowledge, especially at the local level. We administered a pre-test before the implementation of club activities and a post-test upon completion of the environmental club program.

Environmental Knowledge Test

The questions in the environmental knowledge test targeted some of the key environmental issues at both local and international levels, such as biodiversity, natural imbalances, water resources, and air pollution. It is worth noting that two questions have already been studied by the pupils as part of their Life and Earth Sciences curriculum. The other five questions are related to the projects and activities carried out by the environmental club. These activities primarily focus on the local environment.

Questionnaire for Environmental Club Member Pupils

This questionnaire aimed to evaluate the projects and activities carried out within the environmental club and their impact on pupils' relationship with the environment, particularly their willingness to adopt pro-environmental behaviours. Among the questions asked in this questionnaire, we note:

1) Do you feel that the activities carried out as part of the environmental club are important and relevant? Answers to this question were collected using a five-point Likert scale: 0 points for "strongly disagree", 1 point for "disagree", 2 points for "indifferent", 3 points for "somewhat agree" and 4 points for "strongly agree".
2) How would you describe your involvement in the activities of the environment club. We offered three choices as an answer to this question: “very well engaged”, “moderately engaged” and “weakly engaged”.
3) Do you intend to eventually participate in the activities of the environment club? We gave five choices as an answer to this question: 1 “Surely yes”, 2 “rather yes”, 3 “not sure”, 4 “no”, 5 “not at all”.
4) Have the activities of the environment club had a positive impact on your future relationship with the environment and particularly your adoption of pro-environmental behaviours? The answer either yes or no.
5) What are your suggestions for improving the programmes and activities of the environment club.

Data Collection

Data collection was face-to-face (through questionnaires) for both teachers and learners. As far as the environmental club is concerned, given that we carried out many practical activities, we cannot measure in detail all the repercussions of these activities on learners' attitudes and pro-environmental behaviour in the short and medium term. However, we have collected indicators on the impact of the environmental club's intervention on improving both learners' environmental knowledge and their relationship with their environment, as well as their predisposition and willingness to adopt pro-environmental behaviours. To ensure the most used methods, we only kept at the results level the proportions of the methods which were declared often used. Data entry and digital coding were carried out using IBM SPSS20 statistical software.

Pedagogical Intervention within the Framework of the Environmental Club

In light of the teaching methods and approaches most appreciated by teachers, as well as those recommended in the literature, particularly those emphasising active learner involvement through problem-solving, experiential, cooperative, and pragmatic approaches, and starting from contextual and meaningful environmental problems for the learners, we have adopted a programme that is simple in its overall structure, rich and diverse in its content, but effective in addressing the challenges of an original, context-based environmental education that interacts with the local environment and its specific issues. We have set three essential objectives for the activities of the environmental club:

Objectives of the Environment Club Programme

1) The understanding of Islamic principles for an original education relating to the environment.
2) In-depth knowledge of the local environment and understanding of its main problems.
3) The commitment of the learners and their participation in the resolution of certain local environmental problems.

Conduct of Activities Related to the 3 Objectives of the Environmental Club Program

The environmental club in our school consisted of 30 pupil members**,** with three volunteer teachers who supervised the club activities. We had a Lfe and Earth Sciences teacher, an Islamic education teacher, and a French language teacher. The club activities were intense and took place over a period of six weeks between February and March 2023, with 2 hours per week (Wednesday afternoons).

Regarding the first objective, the Islamic education teacher supervised three research projects carried out by three groups of learners on the "Islamic principles for an original education relating to the environment." The outcome of this project was presented in a plenary conference attended by all club members and students from the school. The principles presented and discussed in the conference are as follows:

- Principle of shared vital resources
- Man as a responsible caretaker of the environment and not its absolute owner
- Principle of moderation and prohibition of any waste
- Principle of environmental preservation and prohibition of pollution
- The call to clear and cultivate the land for the benefit of humans and living beings.

For the second objective, “The more or less in-depth knowledge of the local environment and the understanding of its main problems”, we planned several activities to deepen the learners' knowledge about their local environment. This knowledge pertains to both the natural environment (mountains, rivers, forests, local biodiversity, endemic species, etc.) and the human-created environment (the main monuments that constitute the heritage of the region). This was achieved through active methods involving learners in research related to their environment. As for the studied

environmental issues, we focused on the main environmental problems that characterise the region, such as pollution of the "Oued Sebou" river, the erosion of local biodiversity through the extinction of certain fish species, urban waste, deforestation, and the overexploitation of certain resources. Within this framework, among the activities carried out, we can mention the following:

- We organised a photography contest regarding local environmental pollution.
- We highlighted the learner's local environment by preparing information sheets about each tree in the school. We asked club members to prepare sheets for each tree, including its name (scientific, French and Arabic), main characteristics, and habitat.
- The life and earth sciences teacher supervised research and a plenary conference on the fish species that have disappeared from the "Sebou" river, the causes of their extinction, and the efforts made to overcome the challenges of water pollution.
- A group of three volunteer club members prepared a presentation supervised by the life and earth sciences teacher on the evolution of forest cover in Morocco and the measures taken to halt forest degradation.

Regarding the third objective “Learner engagement and participation in solving certain local environmental problems”. After knowing the essential of his/her local environment and its problems, the learner was put in a situation of action to participate in the resolution of some of the problems of his region. Among the activities carried out are:

- Tree planting: Areas behind certain classrooms in the school were filled with litter and waste. In collaboration with the parents' association, we cleaned up the trash, prepared the area, and planted olive and date palm trees.
- Waste collection in the "Ain Chkef" forest, along with several gardening and waste collection activities within our school. These activities were carried out through collaboration between the environmental club and the parents' association.
- Recycling activities: The French language teacher conducted recycling workshops with club members. They created beautiful artwork and useful items (decorations, pencil cases, baskets, etc.) from commonly discarded materials. We organised an exhibition of the products made.

Data Analysis

Data analysis was based mainly on descriptive statistics and enabled us to identify correlations between the variables studied. The descriptive statistics focus on the teaching methods used and the approaches favoured by the teachers of the three subjects studied. We also assessed learners' opinions on the activities carried out as part of the environmental club, and their impact on the evolution of their relationship with the environment. Exploring the different correlations between dependent and independent variables allowed us to detect highly significant correlations and weaker or non-significant ones. Indeed, we found correlations with gender, others between certain methods and between certain pedagogical approaches.

For the environmental knowledge test (learners), we carried out comparisons between the experimental sample and the control sample before and after the environmental club activities had been carried out (pre-test and post-test). Such comparisons provided us with reliable indicators of the effectiveness of the activities carried out by the environmental club.

Results

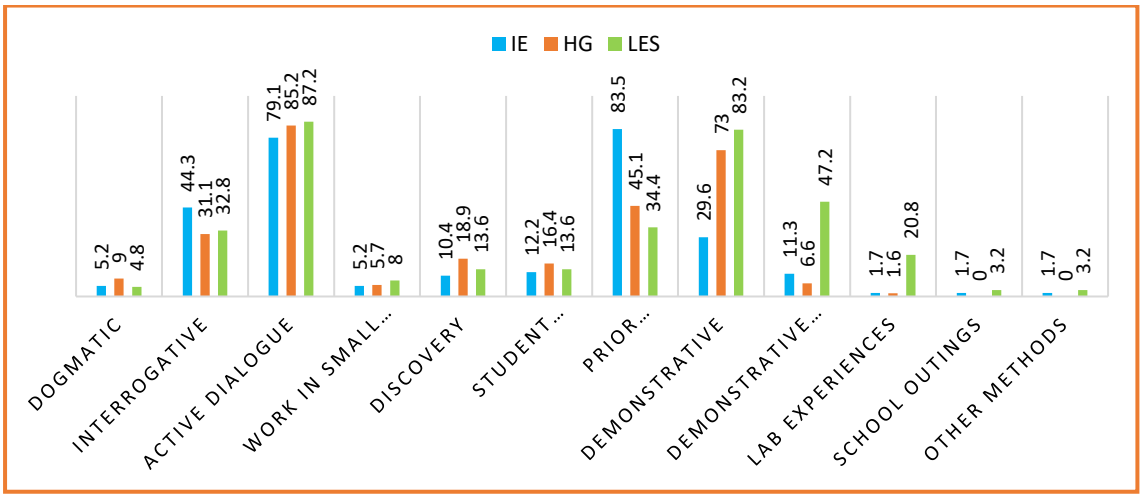
Pedagogical Methods

Figure 2 shows that active dialogue is the most used teaching method in the three subjects. The demonstrative method is often used mainly for teachers of life and earth sciences (LES) and history-geography (HG) while the teachers of Islamic education (IE) made extensive use of pupils'

advance preparations, in addition to the active dialogue and, to a lesser extent, the interrogative method. The demonstration by means of ICT is only used significantly at the level of LES courses. The other methods are very poorly represented in the three subjects, namely the dogmatic method, the work in small groups, the discovery method, and pupil presentations. School trips are almost non-existent.

Figure 2

Percentage of teachers in each subject who often use the mentioned teaching methods

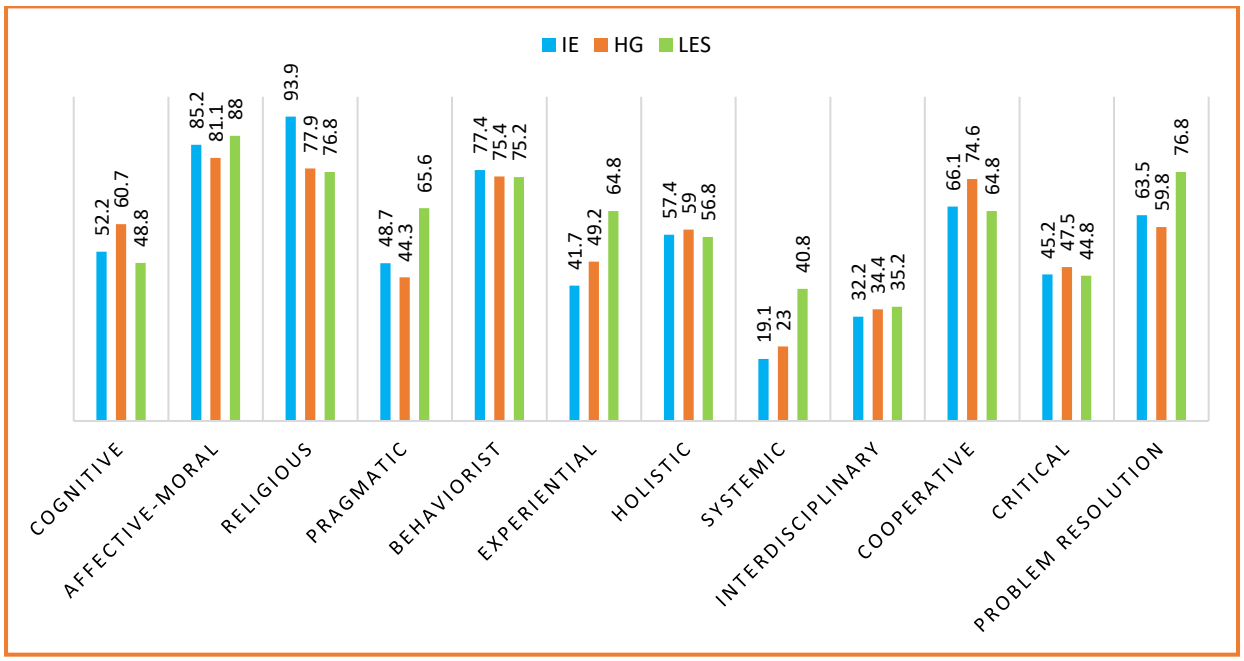


Pedagogical Approaches

Most teachers are in favour of adopting several approaches in environmental education (EE) (eclectic position). The preferred approaches are the affective-moral approach, the religious approach, the behaviourist approach, the cooperative approach, and problem-solving approach (Figure 3).

Figure 3

Percentage of "strongly agree" opinions for each type of pedagogical approach



Correlations with the Teacher's Gender

Regarding LES, we found a significant positive correlation between the gender of the teacher of LES and the use of ICT. In fact, female teachers use ICT more compared to their male colleagues (Table 7).

Table 7

Correlation gender/use of ICT in life and earth sciences

			Demonstration by ICT
Spearman's Rho	Teacher Gender	Correlation coefficient	.260**
		Sig. (2-tailed)	.003
		N	125

Note. **. Correlation is significant at the 0.01 level (2-tailed).

Table 8

Comparison of the number of LES teachers who often use ICT according to gender

	Gender			Total
	No answer	Male teachers	Female teachers	
Teachers who often use ICT	2	9 (26%)	48 (56%)	59
Total	6	34	85	125

Correlations between Approaches and Active Methods

Some approaches and active methods have shown very significant correlations between them. First, the problem-solving approach is closely linked to three other approaches which are the experiential approach, the cooperative approach, and the pragmatic approach (Table 9). On the other hand, the method of discovery is strongly correlated with the students' presentations (Table 10).

Table 9

Correlations with the Problem-solving Approach

			Experiential Approach	Cooperative Approach	Pragmatic Approach
Spearman's Rho	Problem Solving Approach	Correlation coefficient	.304**	.265**	.189**
		Sig. (2-tailed)	.000	.000	.000
		N	362	362	362

Note. **. Correlation is significant at the 0.01 level (2-tailed).

We also recorded a highly significant correlation between the behaviourist approach and the pragmatic approach (correlation coefficient = 0.318 with a significance level of 0.01). In addition to another significant correlation between the religious approach and the affective-moral approach (correlation coefficient = 0.150 with a significance level of 0.01).

Table 10

Correlation between discovery method and student presentations

			Discovery method
Spearman's Rho	Student Presentations	Correlation coefficient	.476**
		Sig. (2-tailed)	.000
		N	362

Note. **. Correlation is significant at the 0.01 level (2-tailed).

Environmental Knowledge Test

An environmental knowledge test was administered to both groups (experimental and control) before starting the club activities and another was administered immediately after the completion of all club activities. Table 11 presents the percentages of students in both groups who obtained their average (grade ≥ 10/20) in the pre-test and post-test.

Table 11

Learners who achieved their average score (10/20) in the environmental knowledge test before (pre-test) and after (post-test) participating in the environmental club activities

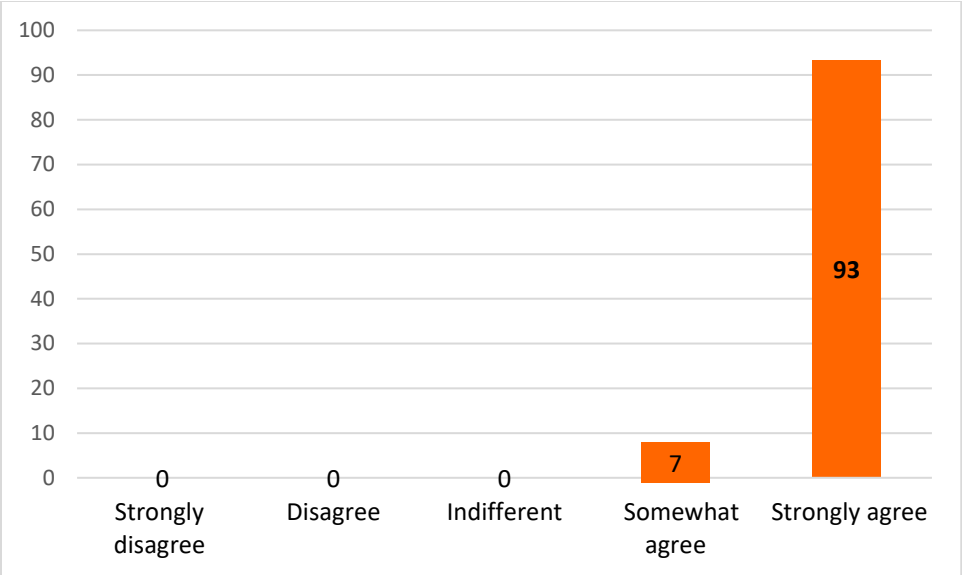
	N (Learners)	Learners who achieved their average in the environmental knowledge test			
		Pre-test		Post-test	
		N1	%	N2	%
Control Sample	30	2	7	6	20
Experimental Sample	30	3	10	29	97

In the pretest, which was conducted before the initiation of the environmental club activities, both types of samples (experimental and control) obtained low scores in the environmental knowledge test. We counted less than 10% of students who were able to obtain the average in this test. Prior to the intervention of the environmental club, we did not observe any significant difference between the control and experimental samples in terms of test results. However, after the completion of the club activities, the same test administered to the same samples yielded significantly different results compared to the initial administration (pretest). Indeed, the percentage of learners who succeeded in this test increased from 7% to 20% for the control sample and from 10% to over 96% for the experimental sample (Table 11).

Learners' Interaction with Environmental Club Activities

Figure 4

Learners' opinions on the importance and relevance of activities carried out within the environmental club

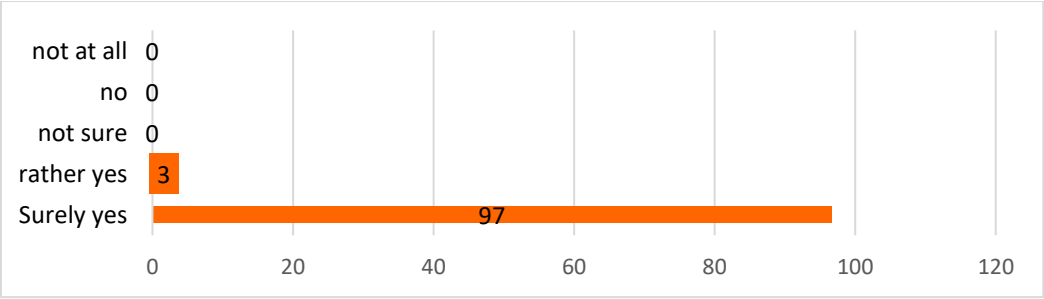


Regarding the first question of the questionnaire aimed at learner members of the environmental club regarding their opinions on the activities carried out, "Do you think the activities conducted within the environmental club are important and relevant?" Figure 4 shows that most surveyed learners (28, or 93%) strongly agree that the activities conducted are important and relevant.

All learner members of the club have stated that they have been highly engaged in club activities. In other words, none of them rated their own engagement as "average" or "low." Furthermore, most surveyed learners expressed their willingness to potentially participate in club activities. In fact, 96.66% responded to question 3 with "Surely yes," while only 3% responded with "Rather yes" (Figure 5).

Figure 5

Learner members of the environmental club who expressed their willingness to potentially participate in the activities of the club



For question 4 of the questionnaire, all learner members of the club (100%) admitted that the activities of the environmental club will have a positive impact on their potential relationship with the environment, particularly their adoption of pro-environmental behaviours.

For the last question regarding suggestions from club members to improve the programmes and activities of the environmental club, the first proposal stated by 18 members (60%) is the organisation of environmental excursions. They propose organising trips to natural sites, reserves, national parks, etc., to learn about the environment in a hands-on manner. In second place, we have two proposals: tree planting (15 members) and environmental awareness activities (50%). As for other suggestions, we have cleaning (10 members) either inside the school or in certain local environmental sites, and finally, some club member learners (6) have proposed organising waste recycling workshops (Figure 6).

Figure 6

Suggestions from club members to improve the programmes and activities of the environmental club

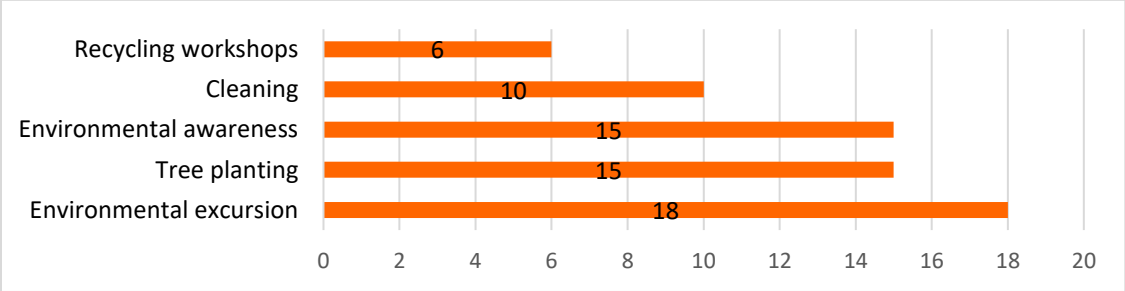


Figure 7

Selected photos from the photography contest regarding local environmental pollution

The learners conducted research supervised by the life and earth science teacher on fish species that have disappeared from the "Sebou" river and the causes of their extinction. They discovered a fish species (the Allis shad: Alosa alosa) that vanished from the river over 20 years ago due to industrial pollution.

Figure 8

The fish species that has disappeared from the "Sebou" river due to industrial pollution is the Allis shad (Alosa alosa)

Figure 9

Excerpts from the sheets prepared by learner members of the club about the trees in the school

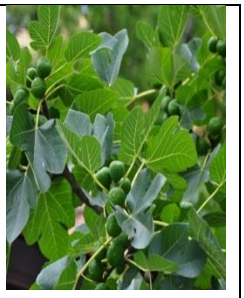
				
Pinus halepensis (Pin d'Alep) الصنوبر الحلبي	Ceratonia siliqua (Caroubier) شجرة الخروب	Olea europaea (Olivier) شجرة الزيتون	Citrus aurantium (Bigaradier) شجرة النارنج	Ficus carica (Figuier) شجرة التين

Figure 10

Gardening and cleaning activities carried out by club members within the school

		
10.1. Gardening activities carried out by student members of the environmental club under our supervision	10.2. Gardening activities carried out by student members of the environmental club under our supervision	10.3. Cleaning of the school's grounds carried out by student members of the environmental club
		
10.4. Beautification of the school's green spaces	10.5. Cleaning of the school's green spaces under our supervision	10.6. Cleaning of all surfaces of the school

Discussion

There are significant differences between the three subjects studied (LES, HG and IE) in terms of the methods often used. This is logical since each subject has its own particularities. We found that the teaching of the three subjects relies mainly on verbal methods centred on the teacher (dialogue, demonstrative method, and interrogative method). This with a remarkable insufficiency about the use of active methods centred on the active involvement of the learner in his own learning (work in small groups, discovery method, student presentations and scientific outings). Such methods are likely to develop learners' autonomy (Feyzioğlu & Demirci, 2021) and their practical skills related to manipulation. In addition to the development of certain social skills linked to interactions and cooperation between students during group work and school outings.

The predominance of the use of verbal methods and the notable lack of implemented active methods have been well confirmed by a recent study that surveyed primary school teachers in the same region (Fes-Meknes) (El Batri et al., 2022). It appears that teachers at the primary and secondary levels work with similar methods. Other research has also confirmed the absence of school outings in Moroccan public schools (El Batri et al., 2019a, 2019b, and 2020a). The methodological shortcomings recorded may be due, according to research that has evoked EE in the same region of Morocco, to a lack of the necessary teaching materials (El Batri et al., 2019b), a lack of motivation (Sayad et al., 2015), and the lack of any formal programme relative to training and continuing education, relating to EE, intended for the benefit of teachers (El Batri et al., 2019b).

The significant increase in the method of prior preparations at the level of the IE subject is not explained by activities (outside the classroom) that encourage research and reflection on the part of the learners. On the contrary, it is about the simple writing of certain contents of the lessons. Teachers of IE systematically ask pupils to write the Qur'anic verses and hadiths of the prophet that relate to each lesson by copying them from the IE textbook. This is to save time in the classroom and to focus on explaining and writing the rest of the lesson. Figure 2 also shows that science subjects (LES) have priority in the use of ICT. This is due because the LES laboratories are the best equipped with digital equipment (PC, data show, digital resources).

Basically, we can say that the pedagogical methods often used are mainly characterised by oral explanation and demonstration. With a very notable lack concerning the active methods arousing the commitment of the learner through personal explorations, experiences, and research activities (discovery method, presentations, work in small groups, outings). Note in this regard that the method of work by small groups has been requested by many researchers to improve the effectiveness of learning (El Batri et al., 2019a; UNESCO, 2017; Polat et al., 2022; Wilson & Varma-Nelson, 2016 and others). School trips, which were absent in the sample studied, proved to be extremely important in EE (El Batri et al., 2019a, 2019b, 2020a; Hoover, 2021; Saribas et al., 2017; Sothmann and Menzel, 2017). The importance of school outings has been confirmed by these researchers concerning several integral dimensions of a person's development (cognitive, socio-emotional, physical and moral). Some authors (El Batri et al., 2019a) have shown that frequent use of several active methods (eclecticism) is an indicator of more effective learning. Along the same lines, de-Oliveira et al (2022) pointed out that teachers need to diversify methodologies in theoretical and practical lessons to foster learning. This, according to the authors, can be achieved by diversifying the teaching process in different ways. Among which, there is the development of practical activities that promote interaction. In this sense, Jeronen et al. (2016) also indicate the group work method and thus appreciated the teaching methods involving the active participation of learners and interactivity.

Regarding the preferred approaches in EE, most teachers are in favour of adopting several approaches (religious, affective-moral, behaviourist, cooperative, problem-solving, etc.). We can say that teachers appreciate an eclectic position regarding the use of pedagogical approaches. We have found this same position in several research studies that have addressed environmental education and sustainable development. In this context, Kopnina (2018) emphasised that the diversity of issues, topics and problems related to sustainability require an eclectic approach to environmental education.

In other research, (Ahmad, 2024; Clark et al., 2017; Pisters et al., 2019) concluded that there are several avenues of research and analysis to reconstruct education for and also in/through, with and about the environment. In addition, Kopina (2018) recognised that plural perspectives of education for sustainable development are promoted by both practitioners and researchers in environmental education.

However, the research that impressed us the most is the one that focused on a sample of Moroccan primary school teachers (El Batri et al., 2022). In this study, they found the same pedagogical approaches most appreciated by teachers as those found in our research (Affective-moral, religious, behaviourist, cooperative, and problem-solving approaches). This means that environmental education should be built, according to the conception of the surveyed teachers, on five essential approaches. For this, it is preferable to start with contextual and relevant environmental issues (problem-solving approach). The contextualisation of environmental education stipulates, among other things, the consideration of indigenous cultures and the religion of the target population. We know that religious grounding is deeply embedded in people's lives in many communities and sometimes determines the type of relationship a person can have with oneself, others, and their environment. Thus, experts in environmental education (Agusalim & Karim, 2024; Parker, 2017) have called for the consideration of religion and indigenous cultures in environmental education programmes.

The religious approach is closely linked to the affective-moral approach (both are correlated at a significance level of 0.01). The affective-moral approach in environmental education aims to evoke positive emotions towards the environment and to develop ethical and responsible values and attitudes regarding nature and environmental issues. According to Cao et al. (2022) and Torsney & Matewos (2022), the affective aspect and the sense of connection are essential for environmental protection and responsibility leading to informed action. Moreover, the behaviourist approach gains its legitimacy from the fact that promoting sustainable pro-environmental behaviours is among the essential goals of environmental education. Therefore, the behaviourist approach can be an effective tool in environmental education (Schneider & Sanguinetti, 2021; Amiri et al., 2024). However, it is essential to combine the behaviourist approach with other approaches that foster a deeper understanding of environmental issues. Finally, the cooperative approach is likely to address several challenges related to environmental education (Arslan, 2025; Colomer et al., 2021). Indeed, the cooperative approach promotes active engagement of learners, the implementation of practical activities, projects, awareness-raising actions, and more. Thus, this approach provides a dynamic and participatory learning framework that allows learners to develop essential skills to address current and future environmental challenges.

In LES, we detected a significant positive correlation between the gender of the teacher and the use of ICT. In fact, female teachers use ICT significantly more than their male colleagues. We have already mentioned that LESs, unlike other subjects, constitute a female subject (77% are women). However, by looking further into the specifics of the samples studied, we found that the vast majority of older teachers (age over 49) are men. Indeed, female teachers with ages below 49 years represent 64% of all female teachers. Whereas men with ages below 49 represent only 26% of all male teachers. That is, the majority of female teachers are younger, and the majority of male teachers (68) are older. We can then link the massive use of ICT by women to the age factor rather than the gender factor.

We have found very significant correlations between certain active approaches and methods. The problem-solving approach is correlated with three other approaches: the experiential, cooperative and pragmatic approach. By synthesizing the definitions given by the researchers who have discussed these approaches (Arslan, 2025; Bloom & Fuentes, 2019; Saleem & Dare, 2023), we found very close rational links between these approaches. The experiential approach aims at direct contact with real situations, the realisation of experiences and interaction with the living environment to develop handling skills, on the one hand, and, on the other hand, to understand natural phenomena. In other words, the experiential approach makes it possible to develop the skills necessary to be able to solve environmental problems. The cooperative approach also aims, among other things, to effectively solve

environmental problems, and the pragmatic approach aims by definition at developing problem-solving skills and eco-management. Therefore, we can say that this is a family of closely related approaches. Even if the researchers cited have evoked these approaches separately, we can say that the experiential, cooperative and pragmatic approaches are only details of the problem-solving approach. This one being the all-encompassing approach of the other three. Consequently, the logical links between these approaches explain and confirm their statistical correlations. Therefore, it is desirable to jointly adopt these approaches. We can say the same thing about the very significant correlation between the discovery method and the students' presentations (Table 10). In fact, the method of discovery underpins the carrying out of research, exploration and investigation by pupils (El Batri et al. 2019a, p. 371). This may involve presentations which can constitute a detail of the method of discovery and can be more general and encompassing. This explains the very significant correlation between the two methods.

The activities carried out within the framework of the environmental club address certain deficiencies observed in the methods used by teachers in the three subjects studied. In particular, there is a notable lack in the use of active methods based on student engagement and exploration. Furthermore, the preferred approaches by the teachers have been effectively implemented by the environmental club through various activities. These approaches include religious, behaviourist, cooperative, and problem-solving approaches. All of these are implemented with the aim of significantly improving the acquisition of environmental knowledge and fostering the willingness to adopt pro-environmental behaviours.

Table 11 demonstrates that the activities carried out by the environmental club have had a highly positive impact on improving the learners' environmental knowledge. This can be attributed to the fact that all the areas covered in the knowledge test were well addressed in the activities conducted by the environmental club. These knowledge areas mainly pertain to the local environment and the contextualization of environmental education. We also incorporated cultural contextualization by referring to the Islamic principles of environmental education. Therefore, this type of knowledge is meaningful and motivating for the learners. Additionally, we employed active methods that actively involved the learners in all the activities conducted by the environmental club. These activities included research work and presentations on the local environment and its specific issues, carrying out meaningful activities in support of the local environment, and participating in resolving certain problems (such as creating fact sheets about the school's trees, tree planting, cleaning, recycling activities, and awareness campaigns).

Furthermore, active learner engagement promotes better knowledge retention. This was clearly demonstrated in the results of the environmental knowledge test (Table 11). When learners are actively involved in hands-on activities, they are more likely to remember the information learned and apply it in real-world contexts. This fosters a true understanding and adoption of ecological concepts and values. We can say that the significant improvement in environmental learning is greatly facilitated when two essential ideas are put into practice: the utilisation of the local environment and its specific issues, along with the active engagement of learners in meaningful environmental education programs. The slight increase in the proportions of learners in the control group who were able to achieve the passing score in the post-test (compared to the pre-test results) (Table 11) can be explained as follows: during the 6-week period between the pre-test and the post-test, some learners were able to gather information on certain questions posed in the test. This may have been accomplished either through the plenary sessions presented by club members or through their independent explorations outside of club activities.

We believe that the experiences undergone by the learners during the activities conducted within the framework of the environmental club will have significant consequences on their knowledge, attitudes, and potential relationship with the environment. They thoroughly enjoyed the activities carried out. Over 93% of the club members perceive the activities as important and relevant. Consequently, they were all highly engaged in the implemented activities. The strong appreciation shown by the learners towards the club's activities is also evident in the expressed willingness of

almost all members to participate in future club activities. This can be considered a success of the club program, as active learner engagement is crucial for the success of any environmental education program. Another indicator of the program's success is that all club members believe that the activities conducted will have a positive impact on their potential relationship with the environment, particularly in adopting pro-environmental behaviours.

Many authors stress the role of personal involvement and the importance of prioritizing local environmental topics. In this regard, Saribas et al. (2017) stated that "Environmental education courses should include presentations, reflections, and discussions on authentic, local, and specific environmental issues." Higde et al. (2017) also highlighted that a closer look into local, tangible and actionable aspects of climate change education result in individual favourable behaviours that support the march towards climate change mitigation. According to Jones and Davison (2021), childhood learning experiences about climate change can have lasting effects. Similarly, Tugurian and Carrier (2017) specified that children possess an environmental identity. This identity can be leveraged, according to the same authors, to enhance the learner's environmental behaviour and strengthen their interest in natural sciences.

To address current environmental issues, it is necessary to reconnect individuals with nature. Nature attachment is a crucial predictive factor for pro-environmental behaviour (Braun and Dierkes, 2017). By focusing on specific problems present in their immediate environment, students can develop a deep understanding of the interconnectedness between their actions and the environment. A key advantage of addressing local environmental issues is the relevance it brings to the educational experience. When learners can directly observe and interact with the environmental challenges in their own community, they develop a personal connection and a sense of responsibility towards seeking solutions (Hastuti et al., 2024; Heiskanen, Thidell & Rodhe, 2016). This hands-on approach fosters a sense of ownership and empowerment, motivating students to act and make a positive impact.

Studies demonstrate that active learner engagement in environmental learning promotes deeper understanding, increased motivation, and lasting behavioural change (Chen & Martin, 2015; El Batri et al., 2019b). Active engagement encourages learners to take an active role in their own learning. When involved in hands-on activities, research projects, field trips, and problem-solving initiatives, learners are more likely to develop natural curiosity, intrinsic motivation, and a sense of personal accomplishment. This approach helps develop essential skills such as critical thinking, problem-solving, collaboration, and informed decision-making.

Research also shows that exposure to nature and active learner engagement in environmental education can have positive effects on their mental and emotional well-being (Passmore & Holder, 2017; Schaubroeck & Rugani, 2017). When engaged in outdoor activities, conservation projects, and community actions, learners develop an emotional connection with nature, which can reduce stress, improve mental health, and foster a sense of connection with their environment.

The proposals put forward to enhance the programs and activities of the environmental club accurately reflect the appreciated activities, whether they have been effectively implemented or requested and desired by the learners. In fact, except for field trips, all the other proposals (Figure 6) have been effectively implemented within the framework of the environmental club program. The inclusion of environmental excursions remains a potential addition. Indeed, several researchers have found that excursions have multiple positive impacts on learners, particularly in cognitive and affective aspects, as well as a significant improvement in motivation and willingness to act in favour of the environment (Behrendt & Franklin, 2014; El Batri et al., 2019a).

Conclusions

This research aimed mainly to achieve three objectives; the first is to reveal the methods used and the pedagogical approaches appreciated by teachers to approach courses related to the environment and environmental education. The second objective was the identification and explanation of certain significant correlations between the pedagogical approaches adopted. As for the

third objective, it was to study, using action research, the impact of the active engagement of learners in a contextualized environmental education program both on the improvement of the acquisition of environmental knowledge and on the willingness to adopt pro-environmental behaviour.

For the first objective, the pedagogical methods often used by the teachers under study are largely dominated by verbal methods centred on the teacher's activity (dialogue, demonstrative method, and interrogative method). Teachers appreciate the adoption of several pedagogical approaches to address environmental issues (the religious, behaviourist, cooperative, and problem-solving approaches). Some of these approaches are closely logically linked and strongly correlated statistically with each other. These include the experiential, cooperative and pragmatic approaches, which, along with the problem-solving approach, constitute a family of closely linked approaches.

The action research related to the third research objective was characterized by an active engagement of learners in a double-contextualized environmental education program. The first contextualization was cultural, integrating Islamic principles of environmental education into the activities carried out, and the second contextualisation involved conducting practical activities targeting the local environment and its specific issues. Overall, we can affirm that the active engagement of learners in contextualised and relevant environmental education programs promotes a significant improvement in the acquisition of environmental knowledge in addition to the development of the willingness to adopt pro-environmental behaviours.

Recommendations

This research is, of course, limited in time and space. The highly beneficial effects of contextualising environmental education at various cognitive and behavioural levels can be confirmed or refuted by further research conducted in other countries and cultures. We recommend that future researchers and practitioners from different regions of the world study the impact of this dual contextualization (cultural and environmental) on the quality of learning related to environmental education and on the resolution of local environmental problems in the short, medium, and even long term.

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