knowledge

Article

Active Learning Increases Knowledge and Understanding of Wildlife Friendly Farming in Middle School Students in Java, Indonesia

Michela Balestri, Marco Campera, Budiadi Budiadi, Muhammad Ali Imron and K. A. I. Nekaris

MDPI

https://doi.org/10.3390/knowledge3030027 knowledge

MDPI

Article

Active Learning Increases Knowledge and Understanding of Wildlife Friendly Farming in Middle School Students in Java, Indonesia

Michela Balestri [1], Marco Campera [2], Budiadi Budiadi [3], Muhammad Ali Imron [3] and K. A. I. Nekaris [1,*]

[1] Nocturnal Primate Research Group, Faculty of Humanities and Social Sciences, Oxford Brookes University, Oxford OX3 0BP, UK; mbalestri@brookes.ac.uk
[2] Faculty of Health and Life Sciences, Oxford Brookes University, Oxford OX3 0BP, UK; mcampera@brookes.ac.uk
[3] Faculty of Forestry, Universitas Gadjah Mada, Yogyakarta 55281, Indonesia; budiadi@ugm.ac.id (B.B.); maimron@ugm.ac.id (M.A.I.)
* Correspondence: anekaris@brookes.ac.uk

Abstract: The main objective of environmental education is to promote pro-environmental behaviors; increasing knowledge and understanding are the first steps. Active learning plays a crucial role in increasing engagement levels and achieving positive behavioral development. We aimed to evaluate the effectiveness of a wildlife-friendly farming curriculum, including active learning, presented to 223 students aged 13–15 years from ten middle schools in Garut Regency, Indonesia, from June to September 2019. Using pre- and post-questionnaires, we found that knowledge retention and understanding increased if students completed an exercise that involved an active discussion with parents and if the class was engaged (monitored via WhatsApp groups) in an active learning experiment. Key concepts regarding wildlife-friendly farming, such as mutual benefits for wildlife and humans, the provision of ecosystem services by animals, and the use of organic farming, were more frequent if students discussed the program with parents or if they were engaged during the experiment. We found evidence that student engagement via active learning increased knowledge retention and understanding of wildlife-friendly farming. Similar approaches should be used to promote wildlife-friendly farming approaches from even younger ages and should be tested with other projects aimed at producing pro-environmental behaviors.

Keywords: knowledge transfer; learning styles; coffee; environmental education; conservation education; agroforestry; STEM; VARK; Bloom's taxonomy; organic

Citation: Balestri, M.; Campera, M.; Budiadi, B.; Imron, M.A.; Nekaris, K.A.I. Active Learning Increases Knowledge and Understanding of Wildlife Friendly Farming in Middle School Students in Java, Indonesia. *Knowledge* **2023**, 3, 401–413. https://doi.org/10.3390/knowledge3030027

Academic Editor: Constantin Bratianu

Received: 27 June 2023
Revised: 21 July 2023
Accepted: 8 August 2023
Published: 10 August 2023

1. Introduction

Conservation education is a type of environmental education with the specific aim of influencing people's knowledge, attitudes, emotions, and behavior about wildlife and wild places [1]. Conservation education is a key element in fighting species extinction [2] by increasing knowledge and promoting positive attitudes [3,4]. The ultimate goal of environmental education is triggering behavioral change, although many conservation education projects achieve only the first step of Bloom's taxonomy of educational objectives [5]—i.e., an increase in knowledge [3,4]. It is often possible to reach the second level of Bloom's taxonomy and have an increase in understanding; thus, pupils can comprehend and interpret the concepts shared during conservation education activities (e.g., they are able to explain a concept in their own words) [6]. Many studies in developing countries high in biodiversity also only assess the short-term increase in knowledge (i.e., immediately after an intervention), and medium- to long-term evaluations are still relatively uncommon [3,7–13].

The main target audiences of conservation education programs are children mainly due to the fact that the development of their attitude towards the environment starts at the early stages of learning, and it is challenging to change it at later stages [14]. Paradoxically, wildlife is threatened with extinction at a fast pace, and understandably, it would be a priority to target an audience whose actions can have rapid effects [15]. A growing body of research indicates that there is a positive influence on children in sharing knowledge with their parents [7,15]. Thus, favoring the communication between children and parents by implementing project activities that include this interaction could reach a wider audience and meet both short- and long-term conservation targets.

High levels of engagement during conservation education activities play a crucial role in achieving positive behavioral development [16,17]. It has been shown that active learning, as a teaching method where individuals are directly involved in their learning process, can increase engagement levels [18,19]. Examples of activities that involve active learning include group discussion, role play, and games used to promote creative thinking, independence, and problem solving [20]. Emerging technologies such as WhatsApp have been recently used to increase engagement in conservation education programs and improve learning experiences (e.g., [21,22]). A learning style is defined as the way an individual gathers, processes, and responds to information [23]. Teachers can apply different learning styles to meet students' preferred learning styles and, thus, create an inclusive learning environment since it has been shown that students' engagement is enhanced through the use of their preferred learning style [24,25]. The VARK (visual, auditory, read/write, and kinaesthetic) model is one of the most common models used in environmental education [23,26,27], indicating that curricula should be implemented considering different learning styles. At the same time, learning styles may change even for an individual during different points along the learning process; therefore, maintaining diversity across a curriculum is crucial.

In Indonesia, smallholder farmers comprise 96% of coffee farmers [28], meaning they have the autonomy to change management strategies in their fields. Already the nature of these smallholder farms include a level of plant diversity and organic management that is friendly to wildlife [29]. This curriculum was in coordination with a larger initiative that aimed at promoting wildlife-friendly and organic practices to coffee farmers in the Garut Regency and other areas in Java [30]. This also included experiments to understand the importance of organic and wildlife-friendly farming in increasing and protecting biodiversity (e.g., butterflies and other pollinators [31,32]; mammals [33]; birds [34]; and invertebrates [35]). In this project, we have already obtained Wildlife Friendly certification for a community of ~400 coffee farmers in Garut regency from the Wildlife Friendly Enterprise Network^{TM} in October 2020 [30].

We aimed to evaluate the effectiveness of a curriculum including active learning and different learning styles in students from middle schools in Indonesia. After the successful development of a curriculum aimed at increasing knowledge on the Critically Endangered Javan slow loris (Primates, *Nycticebus javanicus*) [11,36], we created a curriculum with the aim of increasing knowledge and understanding of the importance of wildlife in coffee fields and on highlighting the importance of organic and wildlife-friendly farming practices. In particular, we investigated the effectiveness of multiple activities on the retention of knowledge. These activities included a frontal lecture inclusive of different learning styles alongside a hands-on experiment (i.e., active learning) for the class with the supervision of teachers and an activity to be completed at home with the help of parents. Our main research question was to understand if our curriculum, including interventions with different learning styles, active learning, and interaction with parents, could bring an increase in knowledge and understanding regarding wildlife-friendly coffee farming. We predicted that this combination of learning styles and varied adult interactions would improve knowledge of organic and wildlife-friendly farming and on the importance of wildlife in coffee fields. We considered that additional factors, i.e., school location and the occupation of the parent, might affect the knowledge retention of students.

2. Materials and Methods

2.1. Participants

We visited ten middle schools with students who were, on average, 13–15 years old in Garut Regency, Indonesia, from June to September 2019. We visited each school twice, with four weeks between visits. A total of 233 students (age: 14.1 ± SD 0.7 years) were present in both sessions and participated in the curriculum. Six schools (126 students) were located in rural areas, and four schools (107 students) were in urban areas. Class sizes ranged from 17 to 29 students (mean: 23.2 ± SD 4.6 students). We do not present the name and locations of the schools to maintain the anonymity of participants.

2.2. Curriculum

We delivered the curriculum in three parts: a teaching session, an experiment for students to be completed with the help of teachers, and an activity to be conducted with the help of parents or an adult guardian at home. The teaching session (a frontal lesson that included a PowerPoint presentation, videos, and interaction with students) was completed during the first visit and lasted around two hours (Table 1).

Table 1. Parts of the curriculum delivered to ten middle schools (233 students) in Garut Regency, Indonesia, with target Bloom levels and learning styles used.

Activity	Type	Bloom's Level	Learning Style
Teaching session	PowerPoint presentation with videos and interaction with students	Knowledge	Visual, auditory
Experiment (Active learning)	Four weeks of the experiment (starting at the end of the teaching session). WhatsApp groups to keep track of class engagement.	Knowledge, understanding	Visual, auditory, read/write, and kinaesthetic
Parent/Guardian test	Questionnaire to complete with parents/guardians at home and requiring discussion of the activities performed in class. A sample of coffee was given to stimulate discussion. A pamphlet with a summary of the information was given to facilitate discussion.	Knowledge, understanding	Visual, auditory, read/write, and kinaesthetic

The topics discussed in the first session were: (1) An introduction to the concepts of conservation biology and an introduction of the project, including some facts about the biology and ecology of the flagship species of the project, the Critically Endangered Javan slow loris; (2) Pollination and seed dispersal and the importance of animals in pollination and seed dispersal; (3) The importance of biodiversity in agroforestry environments; (4) The importance of wildlife in coffee plantations; (5) What is wildlife friendly and organic coffee and why it is important to promote it. At the end of the first session, we left a pamphlet with a summary of the information, including pictures, which was given to each student so that students had the chance to check their notes independently.

At the end of the first session, we initiated a hands-on experiment for students to perform at their schools for four weeks. Each class was given two coffee seedlings and two different fertilizers—one organic and one inorganic (NPK fertilizer) [32]. With the organic fertilizer, we also provided EM4, an organic component (phytohormones plus micronutrients) to add to the fertilizer for better growth performance [30]. We also asked each class to join a WhatsApp group, and we asked teachers to join the group as well to make sure the whole class was active and uploading pictures of the plants and commenting on the advances of the experiment (e.g., growth of the plants, issues) every week. This was a group activity where teachers were responsible for handling the fertilizers and uploading content to the WhatsApp group. We considered a class engaged when we received weekly updates (pictures of plants and comments on the experiment) for the whole duration of the experiment.

At the end of the first session, we also gave samples (30 g) of ground coffee from our Wildlife Friendly coffee farmers for the parents/guardians to taste. To favor a discussion of what organic is and the importance of organic farming, we provided two types of coffee, one organic and one inorganic, with different labels. We asked the students to give a questionnaire to their parents (to be completed together), including the key arguments that we discussed in the first session. After four weeks, we went back to each school to perform a post-test. The class with the best plant and the most active class in the WhatsApp group received a prize (a whiteboard and some equipment for the school). In the second session, we also collected the questionnaire completed by parents/guardians (Figure 1).

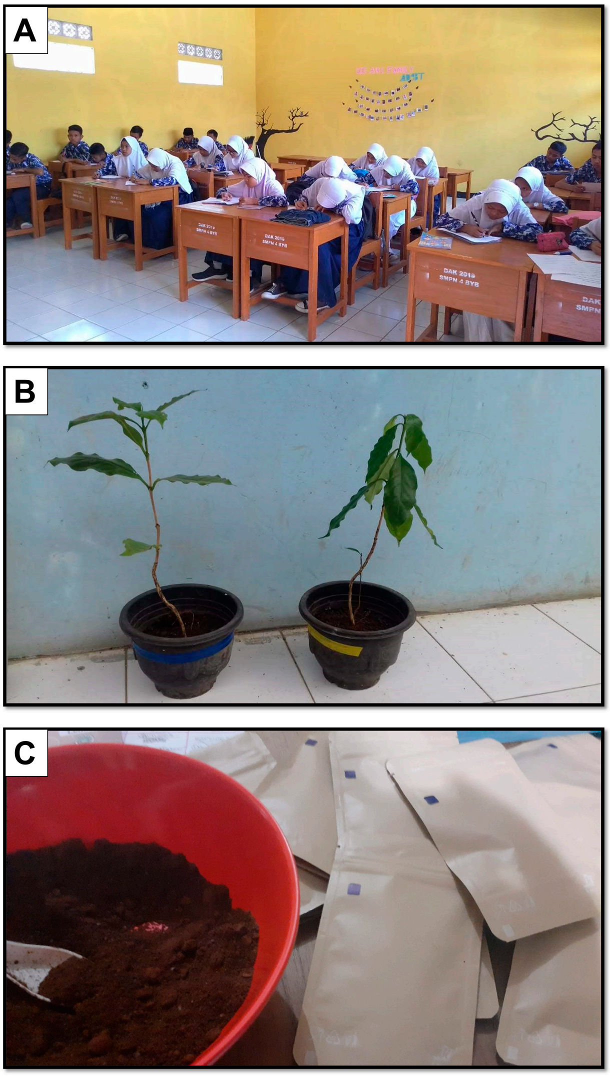

Figure 1. Representation of the different parts of the curriculum delivered to ten middle schools (233 students) in Garut Regency, Indonesia: (**A**) Pre-test conducted before the frontal lecture; (**B**) Coffee plants given to each school for the 4-week experiment; (**C**) Samples of ground coffee given to each pupil to stimulate discussion with their parents/guardians.

2.3. Questionnaires

We used open-ended questionnaires [37]. In the pre-questionnaire (first session), we asked the following questions: (1) Name; (2) Occupation of the father and mother; (3) What do you know about Javan slow loris (we used the term “kukang”—the local name of the animal); (4) What is the meaning of organic and wildlife-friendly coffee? What are the benefits? (5) Are there animals that can help coffee plantations? How do they help?

In the post-questionnaire (second session), we repeated questions 4 and 5 of the pre-questionnaire. For convenience, in the results, we refer to these questions as "questions on organic and wildlife-friendly farming" and "questions on the importance of animals for coffee plants". In addition, we asked if they participated in the previous session, what they liked about that session, and if they discussed the session with parents/guardians. The questionnaire given to parents/guardians included the questions: (1) Do you often drink coffee? If so, which kind of coffee? (2) Have you tried the coffee with the blue label (organic) or no label (inorganic)? (3) Did you like that coffee? And why do you like it? (4) Do you know anything about organic coffee and the benefits of it? (5) What is your opinion about the obstacles to producing organic coffee? (6) Do animals help coffee plants? If so, how? These questions were meant to indicate whether the student discussed the topic with their parents/guardians.

2.4. Data Analysis

We translated the questionnaires from Bahasa Indonesian to English. We coded the two questions that were asked in both sessions based on common themes. We also considered the order if multiple answers were given to the questions. We plotted the proportional rank and the frequency of the answers given. The proportional rank is the average rank of the responses for each student who provided an answer [37]. The proportional rank for each student was calculated as 1/order of the answer, e.g., 1 for the first answer, 0.5 for the second answer, and 0.33 for the third answer.

To evaluate if the answers to the post-questionnaire were influenced by factors, we further grouped the answers to the two questions. We ran Generalized Linear Mixed Models for each of the answers (the binary outcome was 1 if the student gave that answer and 0 if the answer was not given) with the school as a random effect. We used the predictors of the school's setting (rural vs. urban), the response to the parent test given (1 if the student discussed with the parents, assessed via the answers to the questionnaire given to parents; 0 if the student did not give back the parent questionnaire or if the answers indicated that the student did not discuss the activity with the parent), engagement with the experiment (1 for students from the schools that provided regular reports on the experiment with coffee plants; 0 for students from the schools that did not provide information on the experiment), and occupation of the parents (1 if at least one of the parents is a farmer; 0 for any other occupations). We present the estimated model means and standard errors. We ran the tests via IBM SPSS v 27 and considered $p = 0.05$ as a level of significance.

3. Results

3.1. Pre-Test Versus Post-Test

A total of 156 students (67.0%) did not provide a response to the question on organic and wildlife-friendly farming in the pre-test. In the pre-test, students mainly referred to organic as "healthy" and "natural" (both 13.1% of the students), while key answers such as "no chemicals" and "livestock manure as fertilizer" were provided by only 5.5% and 3.8% of the students, respectively (Figure 2A). The number of students who did not provide a response decreased to 103 (44.2%) in the post-test, and students provided more correct answers (Figure 2B). For example, the answer "no chemicals" was provided by 15.5% of the students, and "livestock manure as fertilizer" was provided by 9.0% of the students. The students were also able to provide more specific terms relative to organic and wildlife-friendly farming, such as "natural waste as fertilizer" (so not just manure) given by 9.9% of the students and other answers that linked to coexistence and mutual benefits, increased animal health, increased productivity, and increased habitat quality/protection.

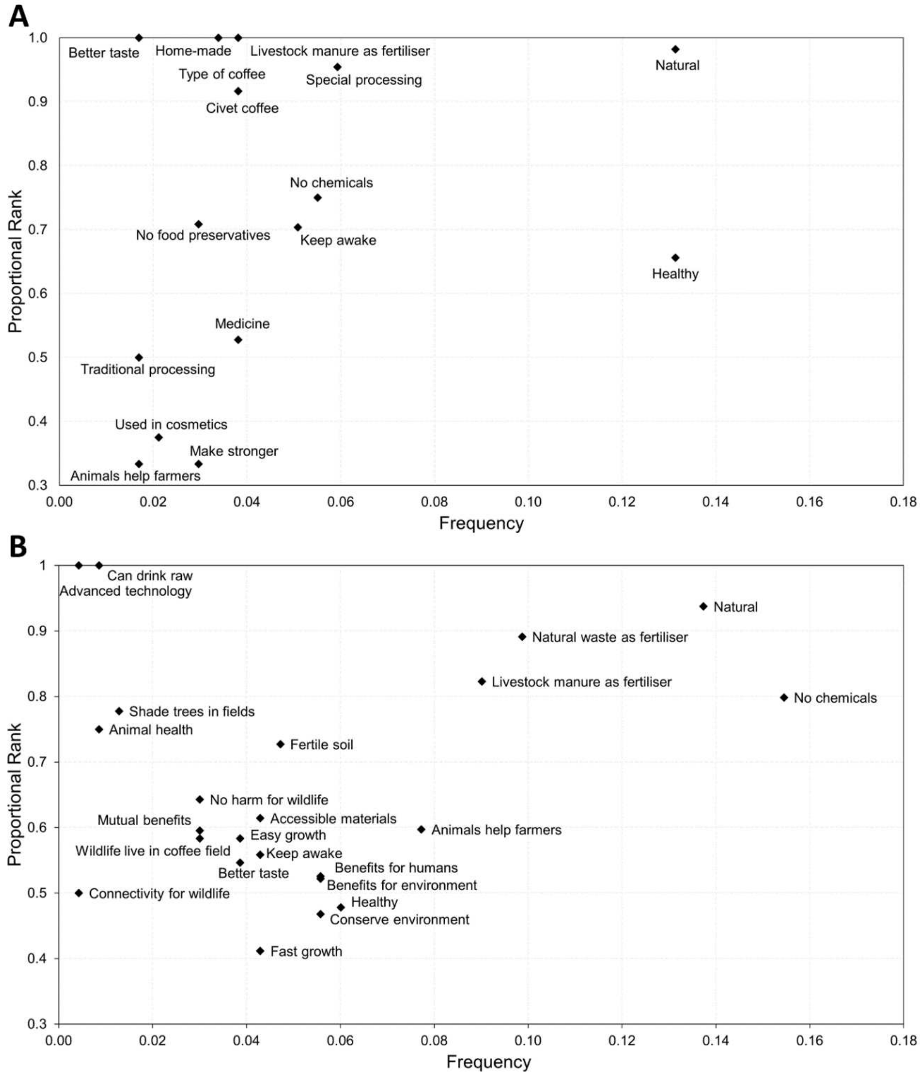

Figure 2. Answers to the question: What is the meaning of organic and wildlife-friendly coffee? What are the benefits? The questionnaire was given at the first session (i.e., pre-test); (**A**) and second session (i.e., post-test); (**B**) in ten schools with 233 students in Garut Regency, Indonesia.

A total of 151 students (64.8%) did not provide a response to the question on the importance of animals for coffee plants in the pre-test. Most of the students who provided answers referred to "civet coffee" (16.1%), a common but unethical practice in the area where civets are put in cages and force-fed to produce civet coffee. The students also provided correct answers such as "animal feces as fertilizer" (14.8%), "worms fertilize soil" (3.9%), and "pollination" (2.1%) (Figure 3A). Some students, however, also provided negative answers such as "hunting dogs" (1.7%) or focused on pests that damage plants. The number of students who did not provide a response decreased to 69 (29.6%) in the post-test, and students provided more correct answers (Figure 3B). Students provided more examples of ecosystem services given by animals: "seed dispersal" (33.0%), "pollination" (25.8%), "select best berries" (4.3%), and "kill coffee pests" (1.7%). Students also gave more examples of animals that were beneficial to farmers, and the percentage of students who referred to "civet coffee" decreased to 3.0%.

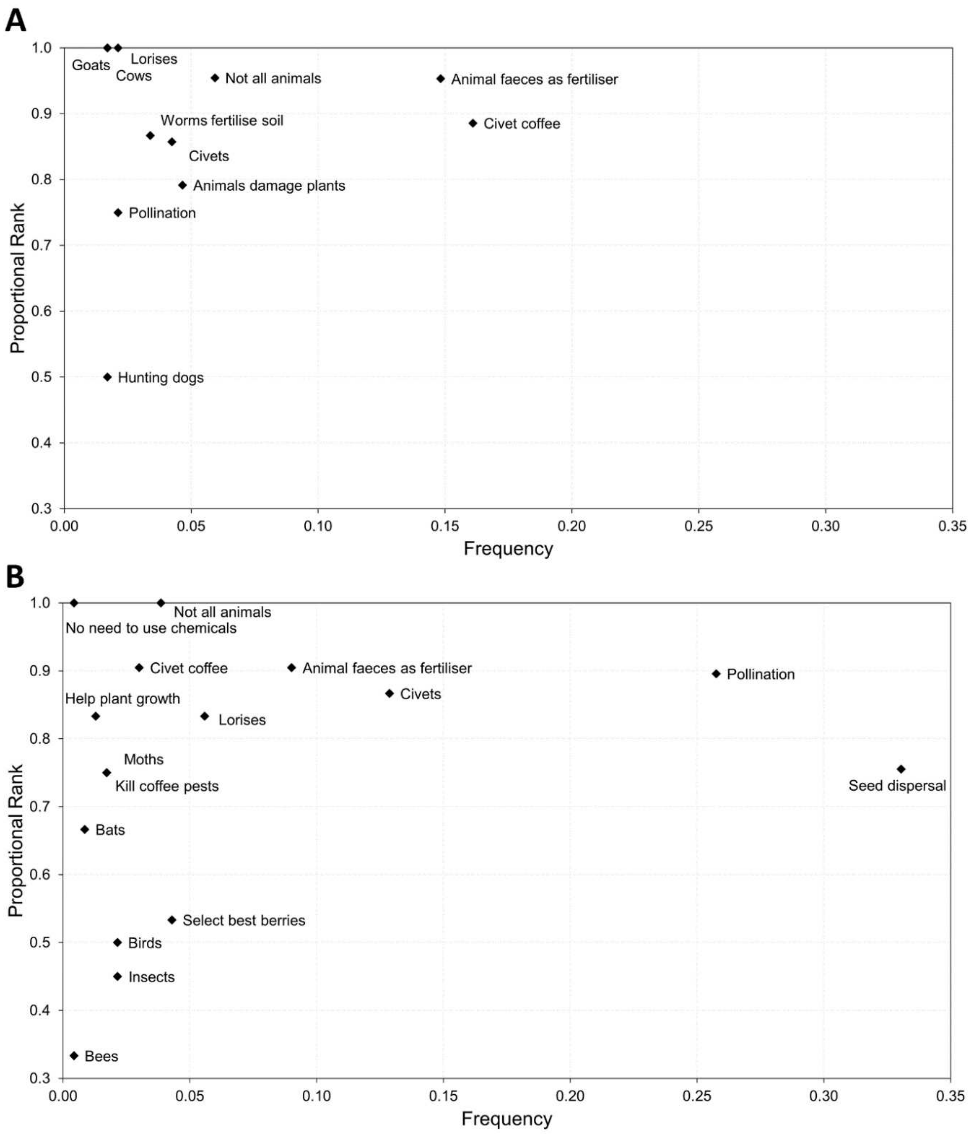

Figure 3. Answers to the question: Are there animals that can help coffee plantations? How do they help? This questionnaire was given at the first session (i.e., pre-test); (**A**) and second session (i.e., post-test); (**B**) in ten schools with 233 students in Garut Regency, Indonesia.

3.2. Predictors of Post-Test Response

The percentage of students who did not give an answer to the question on organic and wildlife friendly-farming on the post-test was more frequent in students who did not present the parent test (73.4 ± SE 6.3% vs. 45.6 ± SE 7.3% of the students who discussed the questionnaire with the parents/guardians) and in students from schools that did not engage with the experiment (80.5 ± SE 7.2% vs. 36.6 ± SE 4.9% of the students from the schools that engaged with the experiment) (Table 2). The percentage of students who gave answers in relation to coexistence and mutual benefits (for humans and wildlife) was higher if the student presented the parent/guardian test (5.9 ± SE 3.0% vs. 1.4 ± 1.1% if the student did not discuss the questionnaire with parents/guardians). The percentage of students who gave answers related to increased coffee productivity was higher in students from rural schools (14.5 ± 6.8% vs. 3.5 ± 1.8% of students from urban schools). The percentage of students who gave answers related to natural farming without chemicals was higher in students from schools that engaged with the experiment (48.3 ± 5.4% vs. 11.5 ± 6.0% of the students from the schools that engaged with the experiment). The other estimates were not significant.

Table 2. Results of the Generalized Linear Mixed Models with responses to the question: What is the meaning of organic and wildlife-friendly coffee? What are the benefits? The questionnaire was given in ten schools to 233 students in Garut Regency, Indonesia.

Response Variable	Predictor	Estimate	Std. Error	T-Value	*p*-Value
No answer	Intercept	0.49	0.25	1.99 *	0.047
	Rural school	0.21	0.22	0.92	0.360
	Parent test	−0.74	0.21	−3.52 **	<0.001
	Experiment	−1.20	0.27	−4.44 **	<0.001
	Farmer parent	0.23	0.25	0.93	0.352
Coexistence and mutual benefits	Intercept	1.66	0.44	3.81 **	0.002
	Rural school	0.14	0.30	0.46	0.650
	Parent test	0.63	0.32	1.98 *	0.048
	Experiment	0.38	0.44	0.85	0.394
	Farmer parent	−0.67	0.44	−1.52	0.130
Increased animal health	Intercept	1.58	0.40	3.97 **	0.001
	Rural school	0.16	0.33	0.49	0.625
	Parent test	0.21	0.34	0.63	0.530
	Experiment	0.41	0.45	0.91	0.365
	Farmer parent	−0.21	0.40	−0.52	0.602
Increased coffee productivity	Intercept	1.82	0.38	4.76 **	<0.001
	Rural school	−0.75	0.30	−2.46 *	0.015
	Parent test	−0.01	0.28	−0.03	0.980
	Experiment	0.25	0.41	0.59	0.555
	Farmer parent	−0.27	0.35	−0.76	0.451
Increased habitat quality/protection	Intercept	1.82	0.46	3.94 **	<0.001
	Rural school	−0.86	0.45	−1.92	0.056
	Parent test	0.27	0.30	0.91	0.363
	Experiment	−0.31	0.54	−0.58	0.564
	Farmer parent	−0.03	0.37	−0.09	0.928
Increased human health	Intercept	1.36	0.47	2.91 **	0.004
	Rural school	−0.29	0.52	−0.56	0.579
	Parent test	0.61	0.33	1.84	0.067
	Experiment	0.18	0.66	0.27	0.791
	Farmer parent	−0.07	0.34	−0.21	0.835
Natural farming without chemicals	Intercept	0.09	0.25	0.38	0.707
	Rural school	−0.42	0.23	−1.81	0.072
	Parent test	0.29	0.21	1.38	0.169
	Experiment	1.16	0.32	3.58 **	<0.001
	Farmer parent	0.03	0.24	0.10	0.920
Use of accessible materials	Intercept	1.52	0.39	3.86 **	<0.001
	Rural school	0.16	0.33	0.49	0.628
	Parent test	0.42	0.34	1.24	0.217
	Experiment	0.32	0.45	0.71	0.477
	Farmer parent	−0.25	0.40	−0.64	0.525

* $p < 0.05$; ** $p < 0.01$.

The percentage of students who did not give an answer to the question on the importance of animals for coffee plants in the post-test was higher in students who did not present the parent/guardian test (43.2 ± SE 7.7% vs. 11.2 ± 4.0% of the students who discussed the questionnaire with the parents/guardians) and in students who did not have a farmer as a parent/guardian (35.2 ± 4.8% vs. 15.8 ± 6.8% of the students who had a farmer as parent) (Table 3). The percentage of students who gave answers relating to the provision of ecosystem services was higher if the student presented the parent test (80.1 ± 5.3% vs. 42.2 ± 7.3% if the student did not discuss the questionnaire with parents). The other estimates were not significant.

Table 3. Results of the Generalized Linear Mixed Models with responses to the question: Are there animals that can help coffee plantations? How do they help? The questionnaire was given in ten schools to 233 students in Garut Regency, Indonesia.

Response Variable	Predictor	Estimate	Std. Error	t-Value	*p*-Value
No answer	Intercept	1.54	0.32	4.88 **	<0.001
	Rural school	−0.24	0.27	−0.90	0.369
	Parent test	−1.04	0.22	−4.68 **	<0.001
	Experiment	0.22	0.28	0.77	0.445
	Farmer parent	−0.62	0.28	−2.25 *	0.025
Help plant growth	Intercept	0.88	0.37	2.38 *	0.018
	Rural school	0.62	0.42	1.48	0.141
	Parent test	0.27	0.28	0.94	0.350
	Experiment	0.17	0.45	0.38	0.706
	Farmer parent	−0.02	0.30	−0.06	0.954
Provide ecosystem services	Intercept	−0.93	0.27	−3.40 **	<0.001
	Rural school	0.13	0.26	0.50	0.616
	Parent/guardian test	1.04	0.22	4.82 **	<0.001
	Experiment	−0.33	0.28	−1.19	0.234
	Farmer parent	0.37	0.24	1.53	0.127

* $p < 0.05$; ** $p < 0.01$.

4. Discussion

Here, we showed how a curriculum developed considering a combination of different learning styles and active learning activities, favoring a clear increase in mid-term (i.e., after a month) knowledge retention and understanding in middle school students in Garut Regency, Indonesia. We developed our curricula using several activities and education materials that were tested in previous projects in Indonesia and other developing countries. For example, we left a pamphlet with a summary of the information given to each student so that the student could check the information at home since providing educational materials to consult at home was found to be an important factor for improving knowledge retention and understanding [8,11,38]. We developed activities for the whole class with the supervision of teachers, as teacher involvement in conservation education has been shown to bring a positive effect on students [11,39].

A key component to improve the knowledge retention and understanding of students was the activity that involved an active discussion between parents/guardians and students. Students who showed proof (i.e., filled questionnaire) that they had a discussion with their parents/guardians about the topics covered in the lecture were able to provide detailed information on complex topics such as the coexistence and mutual benefits of farmers and wildlife and the provision of ecosystem services by wildlife. Several studies demonstrated knowledge transfer between parents and children participating in conservation education programs (e.g., [7,15]). The retention of complex information relating to environmental issues is particularly complex even for educators [9]; thus, our findings are particularly promising for the future of conservation education. We suggest that the discussion of the curricula with parents helps students to understand more complex topics, and we advocate the use of similar activities when developing conservation education curricula.

The second key activity that brought an evidential increase in knowledge retention by students was the experiment with coffee plants under the supervision of teachers. Students from schools that engaged with the experiment, in fact, gave more answers and were particularly successful in understanding that organic farming is natural in farming without chemicals. The experiment involved, in fact, the use of two types of fertilizers (i.e., organic and chemical), meaning that students had to actively engage in this activity under the supervision of teachers. This experiment was a clear example of how active learning through practical activities and interactions with other students and educators can increase engagement levels and, thus, their knowledge and understanding of the topic [19]. Thinking about the development of pro-environmental behaviors, a direct experience with nature has been shown as a key factor in determining young people's paths and conservation education outcomes in developing countries [40].

Students from rural schools better retained the information that wildlife-friendly and organic farming can lead to increased coffee productivity compared to students from urban areas. In conservation education, it has often been found that students and educators living in a rural context are more likely to retain knowledge relating to environmental issues [3,7,9,10]. Knowledge retention from these participants is often better than from participants from urban areas, although educators from rural areas in developing countries are expected to have lower academic preparation compared to teachers from main urban areas such as Garut [41]. Brown et al. [11] suggested that students from several rural areas of Indonesia were keener on learning about Javan slow loris than students from urban areas since they were more likely to have had personal experiences of interacting with the animal. It is evident that the context of the school should be considered when developing and implementing an environmental education curriculum.

One of the findings in our study was that the response rate was relatively low, especially in the pre-test. While we believe that most of the students who left the questionnaire blank did not know the answer, we also think that a minority of students did know some of the answers and did not reply. In fact, during the presentation and in the first session, we interacted with students after they filled out the questionnaire at the beginning of the session, and we found that students from some schools had some knowledge of the topics but did not reply to the related questions. This could relate to a difference in culture as, at the beginning of each session, we asked the students to leave the questions blank if they did not know the answer. That might have made some students reluctant to attempt an answer even if they had some knowledge of the topic. We are confident, however, that the findings are coherent with the design of the study and that the knowledge increase was tangible and dependent on the diverse activities and learning styles used in our curriculum. In addition, the teaching sessions were always conducted with the same educators. We, thus, think that this limitation did not bias our results, but we would like to warn practitioners that a similar issue might arise.

5. Conclusions

In conclusion, we found evidence that student engagement via active learning and the use of diverse learning styles increased knowledge retention and understanding of wildlife-friendly farming in middle school students in Garut Regency, Indonesia. Indonesia's national curriculum encourages educators to create multi-style learning environments through a range of different activities [42], and we achieved this throughout the development and delivery of our conservation education program. We must highlight that an increase in knowledge and understanding from an environmental education program does not necessarily result in behavioral changes [3,43], and as such, other actions are necessary to reach a behavioral change that can result in long-term benefits in the area. Several barriers can prevent the emergence of pro-environmental behaviors after conservation education interventions [44]; therefore, careful planning should be considered to reduce those barriers. We are promoting other actions in the Garut Regency to encourage wildlife-friendly farming among farmers [30], and in the future, it will be important to link these actions with further curricula that aim at including interactions between students, educators, and other adults.

Author Contributions: Conceptualization, M.B. and K.A.I.N.; methodology, M.B. and M.C.; software, M.B. and M.C.; validation, M.B. and M.C.; formal analysis, M.B. and M.C.; investigation, M.B.; resources, M.B., M.C., B.B., M.A.I. and K.A.I.N.; data curation, M.B. and M.C.; writing—original draft preparation, M.B. and M.C.; writing—review and editing, B.B., M.A.I. and K.A.I.N.; visualization, M.B. and M.C.; supervision, B.B., M.A.I. and K.A.I.N.; project administration, M.B., M.C. and K.A.I.N.; funding acquisition, M.B., M.C. and K.A.I.N. All authors have read and agreed to the published version of the manuscript.

Funding: The project was funded by Augsburg Zoo, Brevard Zoo, Cleveland Zoo and Zoo Society, Columbus Zoo and Aquarium, Disney Worldwide Conservation Fund, Global Challenges Fund, Henry Doorly Zoo, International Primate Protection League, Mohamed bin al Zayed Species Conservation Fund (182519928), Margot Marsh Biodiversity Fund, Memphis Zoo, Moody Gardens Zoo, Paradise Wildlife Park, People's Trust for Endangered Species, Phoenix Zoo, Primate Action Fund, Shaldon Wildlife Trust, Sophie Danforth Conservation Biology Fund, and ZGAP.

Institutional Review Board Statement: The field research was approved by RISTEK (research permit 24/FRP/E.5/Dit.KI/I/2019). We obtained additional permits from the branch of the Ministry of Education in Garut before visiting the schools. This study was conducted according to the guidelines of the Declaration of Helsinki and was approved by the Oxford Brookes University Ethics Committee (number 181256, 1 February 2019).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy reasons.

Acknowledgments: We thank Indonesia RISTEK and the Ministry of Education in Garut for authorizing this study. We thank D. Ahmad for helping during the teaching sessions.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

References

1. Gusset, M.; Lowry, R. Towards effective environmental education. *WAZA Mag.* **2014**, *15*, 1–48.
2. Tsoi, K.H.; Sau, Y.C.; Yeung, C.L.; Brian, H.Y.I.; Chi, C.C. Shark conservation: An educational approach based on children's knowledge and perceptions toward sharks. *PLoS ONE* **2016**, *11*, e0163406.
3. Kuhar, C.W.; Bettinger, T.L.; Lehnhardt, K.; Osuo, T.; Cox, D. Evaluating for long-term impact of an environmental education program at the Kalinzu Forest Reserve, Uganda. *Am. J. Primatol.* **2010**, *72*, 407–413. [CrossRef]
4. Van der Ploeg, J.; Cauilan-Cureg, M.; van Weerd, M.; De Groot, W.T. Assessing the effectiveness of environmental education: Mobilizing public support for Philippine crocodile conservation. *Conserv. Lett.* **2011**, *4*, 313–323.
5. Bloom, B.S. *Taxonomy of Educational Objectives: The Classification of Educational Goals*; McKay: New York, NY, USA, 1956.
6. Anderson, L.; Krathwohl, R.; Airasian, P.; Cruikshank, K.; Mayer, R.; Pintrich, P.; Raths, J.; Wittrock, M. *Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy*; Longman: New York, NY, USA, 2001.
7. Rakotomamonjy, S.N.; Jones, J.P.G.; Razafimanahaka, J.H.; Ramamonjisoa, B.; Williams, S.J. The effects of environmental education on children's and parents' knowledge and attitudes towards lemurs in rural Madagascar. *Anim. Conserv.* **2015**, *18*, 157–166. [CrossRef]
8. Richter, T.; Rendigs, A.; Maminirina, C.P. Conservation messages in speech bubbles–Evaluation of an environmental education comic distributed in elementary schools in Madagascar. *Sustainability* **2015**, *7*, 8855–8880.
9. Balestri, M.; Campera, M.; Nekaris, K.A.-I.; Donati, G. Assessment of long-term retention of environmental education lessons given to teachers in rural areas of Madagascar. *Appl. Environ. Educ. Commun.* **2017**, *16*, 298–311. [CrossRef]
10. Grúňová, M.; Brandlová, K.; Svitálek, J.; Hejcmanová, P. Environmental education supports conservation action by increasing the immediate and long-term environmental knowledge of children in West Africa. *Appl. Environ. Educ. Commun.* **2017**, *16*, 3–16.
11. Brown, E.R.; Imron, M.A.; Campera, M.; Nekaris, K.A.I. Testing efficacy of a multi-site environmental education programme in a demographically and biologically diverse setting. *Environ. Conserv.* **2020**, *47*, 60–66.
12. Cheang, C.-C.; Ng, W.-K.; Wong, Y.-S.D.; Li, W.-C.; Tsoi, K.-H. Planting a seed of experience–Long term effects of a co-curricular ecogarden-based program in higher education in Hong Kong. *Front. Psychol.* **2021**, *11*, 583319. [CrossRef]
13. Valenzuela-Morales, G.Y.; Hernández-Téllez, M.; Ruiz-Gómez, M.D.L.; Gómez-Albores, M.A.; Arévalo-Mejía, R.; Mastachi-Loza, C.A. Water conservation education in elementary schools: The case of the Nenetzingo river catchment, Mexico. *Sustainability* **2022**, *14*, 2402. [CrossRef]

14. Jiménez, A.; Díaz, M.J.; Monroe, M.C.; Benayas, J. Analysis of the variety of education and outreach interventions in biodiversity conservation projects in Spain. *J. Nat. Conserv.* **2015**, *23*, 61–72. [CrossRef]
15. Damerell, P.; Howe, C.; Milner-Gulland, E.J. Child-orientated environmental education influences adult knowledge and household behaviour. *Environ. Res. Lett.* **2013**, *8*, 015016. [CrossRef]
16. Reschly, A.L.; Christenson, S.L. Jingle, jangle, and conceptual haziness: Evolution and future directions of the engagement construct. In *Handbook of Research on Student Engagement*; Christenson, S.L., Reschly, A.L., Wylie, C., Eds.; Springer: New York, NY, USA, 2012; pp. 97–131.
17. Wang, M.T.; Degol, J.L.; Henry, D.A. An integrative development in sociocultural-context model for children's engagement in learning. *Am. Psychol.* **2019**, *9*, 1086–1102. [CrossRef] [PubMed]
18. Freeman, S.; Eddy, S.L.; McDonough, M.; Smith, M.K.; Okoroafor, N.; Jordt, H.; Wenderoth, M.P. Active learning increases student performance in science, engineering, and mathematics. *Proc. Natl. Acad. Sci. USA* **2014**, *111*, 8410–8415. [CrossRef]
19. Hopper, M.K.; Brake, D.A. Student engagement and higher order skill proficiency: A comparison of traditional didactic and renewed integrated active learning curricula. *Adv. Physiol. Educ.* **2018**, *42*, 685–692.
20. Bonwell, C.C.; Eison, J.A. Active learning: Creating excitement in the classroom. In *1991 ASHE-ERIC Higher Education Reports*; Association for the Study of Higher Education; ERIC Clearinghouse on Higher Education, The George Washington University, School of Education and Human Development: Washington, DC, USA, 1991; ISBN 1-878380-06-7.
21. Nedungadi, P.; Mulki, K.; Raman, R. Improving educational outcomes & reducing absenteeism at remote villages with mobile technology and WhatsAPP: Findings from rural India. *Educ. Inf. Technol.* **2018**, *23*, 113–127.
22. Moreno-Guerrero, A.J.; Rodríguez-Jiménez, C.; Ramos-Navas-Parejo, M.; Soler-Costa, R.; López-Belmonte, J. WhatsApp and Google Drive Influence on Pre-service Students' Learning. *Front. Educ.* **2020**, *5*, 152. [CrossRef]
23. Fleming, N.; Baume, D. *Learning Styles Again: Varking Up the Right Tree! Educational Developments*; SEDA Ltd.: Blackwood, UK, 2006; Volume 7, pp. 4–7.
24. Franquesa-Soler, M.; Barraza, L.; Serio-Silva, J.C. Children's learning preferences for the development of conservation programs in Mexican communities. *J. Educ. Res.* **2018**, *112*, 28–37. [CrossRef]
25. Burke, K.; Dunn, R. Learning style-based teaching to raise minority student test scores: There's no debate! *Soc. Stud.* **2003**, *94*, 167–170.
26. Dunn, R.; Dunn, K. *Teaching Secondary Students through Their Individual Learning Styles: Practical Approaches for Grades 7–12*; Allyn & Bacon: Boston, MA, USA, 1993.
27. Grogan, K.E.; Henrich, C.C.; Malikina, M. Student engagement in after-school programs, academic skills and social competence among elementary school students. *Child Dev. Res.* **2014**, *2014*, 498506. [CrossRef]
28. Ibrahim, H.W.; Zailani, S. A review on the competitiveness of global supply chain in a coffee industry in Indonesia. *Int. Bus. Manag.* **2010**, *4*, 105–115.
29. Okubo, S.; Parikesit; Harashina, K.; Muhamad, D.; Abdoellah, O.S.; Takeuchi, K. Traditional perennial crop-based agroforestry in West Java: The tradeoff between on-farm biodiversity and income. *Agrofor. Syst.* **2010**, *80*, 17–31.
30. Campera, M.; Budiadi, B.; Adinda, E.; Ahmad, N.; Balestri, M.; Hedger, K.; Imron, M.A.; Manson, S.; Nijman, V.; Nekaris, K.A.I. Fostering a wildlife-friendly program for sustainable coffee farming: The case of small-holder farmers in Indonesia. *Land* **2021**, *10*, 121.
31. Campera, M.; Balestri, M.; Manson, S.; Hedger, K.; Ahmad, N.; Nijman, V.; Budiadi, B.; Imron, M.A.; Nekaris, K.A.I. Shade trees and agrochemical use affect butterfly assemblages in coffee home gardens. *Agric. Ecosyst. Environ.* **2021**, *319*, 107547. [CrossRef]
32. Manson, S.; Nekaris, K.A.I.; Hedger, K.; Balestri, M.; Ahmad, N.; Adinda, E.; Budiadi, B.; Imron, M.A.; Nijman, V.; Campera, M. Flower visitation time and number of visitor species are reduced by the use of agrochemicals in coffee home gardens. *Agronomy* **2022**, *12*, 509. [CrossRef]
33. Campera, M.; Hedger, K.; Birot, H.; Manson, S.; Balestri, M.; Budiadi, B.; Imron, M.A.; Nijman, V.; Nekaris, K.A.I. Does the presence of shade trees and distance to the forest affect detection rates of terrestrial vertebrates in coffee home gardens? *Sustainability* **2021**, *13*, 8540. [CrossRef]
34. Imron, M.A.; Campera, M.; Al Bihad, D.; Rachmawati, F.D.; Nugroho, F.E.; Budiadi, B.; Wianti, K.F.; Suprapto, E.; Nijman, V.; Nekaris, K.A.I. Bird assemblages in coffee agroforestry systems and other human modified habitats in Indonesia. *Biology* **2022**, *11*, 310. [CrossRef]
35. Campera, M.; Budiadi, B.; Bušina, T.; Fathoni, B.H.; Dermody, J.; Nijman, V.; Imron, M.A.; Nekaris, K.A.I. Abundance and richness of invertebrates in shade-grown versus sun-exposed coffee home gardens in Indonesia. *Agrofor. Syst.* **2022**, *96*, 829–841. [CrossRef]
36. Nekaris, K.A.I.; McCabe, S.; Spaan, D.; Imron, M.A.; Nijman, V. A novel application of cultural consensus models to evaluate conservation education programs. *Conserv. Biol.* **2018**, *32*, 466–476. [CrossRef]
37. Newing, H.S.; Eagle, C.M.; Puri, R.K.; Watson, C.W. *Conducting Research in Conservation: A Social Science Perspective*; Routledge: Abingdon, UK, 2011.
38. Andresen, E.; López-del-Toro, P.; Franquesa-Soler, M.; Mora, F.; Barraza, L. Teenagers' awareness about local vertebrates and their functions: Strengthening community environmental education in a Mexican shade-coffee region to foster animal conservation. *Sustainability* **2020**, *12*, 8684.

39. De White, T.G.; Jacobson, S.K. Evaluating conservation education programs at a south American zoo. *J. Environ. Educ.* **1994**, *15*, 18–22. [CrossRef]
40. Reibelt, L.M.; Richter, T.; Rendigs, A.; Mantilla-Contreras, J. Malagasy conservationists and environmental educators: Life paths into conservation. *Sustainability* **2017**, *9*, 227. [CrossRef]
41. McEwan, P.J. Recruitment of rural teachers in developing countries: An economic analysis. *Teach. Teach. Educ.* **1999**, *15*, 849–859. [CrossRef]
42. Rudy, P.C. The perspective curriculum in Indonesia on environmental education. *Int. J. Educ. Res.* **2015**, *4*, 77–83.
43. Schultz, P. Conservation means behaviour. *Conserv. Biol.* **2011**, *25*, 1080–1083. [CrossRef] [PubMed]
44. Schüßler, D.; Richter, T.; Mantilla-Contreras, J. Educational approaches to encourage pro-environmental behaviors in Madagascar. *Sustainability* **2019**, *11*, 3148. [CrossRef]