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A PROCESS AND TOOLS FOR EVALUATING BIRD BANDING EDUCATION SUCCESS

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Abstract. Bird banding education programs are growing in number throughout North America. Past research reveals that many of these bird banding education programs share the primary goals of educating about conservation, inspiring bird appreciation, and demonstrating the link between science and conservation. However, there has been limited evaluation of the effectiveness of bird banding education in accomplishing these goals. In 2007, Klamath Bird Observatory undertook a comprehensive evaluation of its bird banding education program for 4/5th grade students. "Songbirds, Science, and Schools" includes a classroom visit that focuses on bird biology and science skills followed by a bird banding field trip. To assess accomplishment of the program goals, multiple tools were used including surveys, interviews, and observations. 284 students and 11 teachers participated in the study. Results demonstrate that students increased their knowledge about birds, science skills, and their awareness of birds but were inconclusive as to whether students increased their intentions to protect birds and their environment. This evaluation illustrates how effectiveness of a banding education program can be measured, demonstrating success in educating about birds and enhancing science skills and illuminating opportunities to improve its conservation outcomes.

Key Words: banding education, bird banding, bird education, evaluation.

EVALUANDO LA EDUCACIÓN SOBRE EL ANILLAMIENTO DE AVES PROCESO Y HERRAMIENTAS PARA EL ÉXITO DE LA EDUCACIÓN SOBRE ANILLAMIENTO DE AVES

Resumen. Los programas educativos sobre el anillamiento de aves están aumentando en número a lo largo y ancho de Norteamérica. Investigaciones anteriores revelan que muchos de estos programas educativos sobre el anillamiento de aves comparten los principales objetivos de educar sobre conservación, fomentar la apreciación de las aves, y demostrar la unión entre ciencia y conservación. Sin embargo, ha habido una evaluación limitada de la efectividad de la educación para anillamiento de aves para alcanzar estos objetivos. En 2007, Klamath Bird Observatory llevó a cabo una completa evaluación de su programa de educación sobre el anillamiento de aves para estudiantes de cuarto y quinto grado. "Aves cantoras, Ciencia, y Escuelas" incluye una visita escolar que se centra en la biología de las aves y habilidades científicas seguida de una salida de campo de anillamiento de aves. Para evaluar el cumplimiento de los objetivos del programa, se emplearon múltiples herramientas, incluyendo encuestas, entrevistas, y observaciones. 284 estudiantes y 11 profesores participaron en el estudio. Los resultados mostraron que los estudiantes aumentaron sus conocimientos sobre las aves, sus habilidades científicas y su sensibilización sobre las aves, pero no fueron concluyentes sobre si se produjo un aumento en la voluntad de protección de las aves y su entorno por parte de los estudiantes. Esta evaluación muestra cómo puede medirse la efectividad de un programa de educación sobre anillamiento, demostrando el éxito en la educación sobre las aves y mejorando las aptitudes científicas y clarificando oportunidades para mejorar sus resultados en conservación.

INTRODUCTION

Increasingly throughout North America, bird banding is being used as a platform for education. Bird observatories and research and nature centers alike utilize their bird banding research as an educational and community outreach tool, showing birds and ornithological research up close to their participants. Audiences include Kindergarten-12th grade classes, college students, community groups, habitat managers, and organizational partners.

A study of bird banding education providers, suggested that in 2004 over 47 000 people

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were reached annually by bird banding education programs (Pitkin 2005). These providers shared three primary goals for their education programs: educating about conservation, inspiring bird appreciation, and demonstrating the link between science and conservation. Twenty-four of the 25 bird banding education providers surveyed believed they are successful at achieving these goals (Pitkin 2005). However, no published research evaluating bird banding education exists.

Evaluation provides a means to understand the impact curriculum and programs have on learners (Smith-Sebasto 2005). Evaluation can be defined as the gathering of information to systematically determine program processes, outcomes, and impacts (Patton 1987, Weiss 1998). It has been shown that education programs need evaluation for the field to grow and develop (Wiltz 2000). Thus, such evaluation is essential for the maturation of the field of bird education. Without it, the field will have little guidance in what variables contribute to program success and meeting shared education goals.

Bray (1976) first addressed the need for evaluation of banding education programs. He stated "banding educators must be involved in educational research if there is to be an increasing effectiveness of banding education" (p. 161). Yet, limited research on banding education has been published in the following three decades. One publication examined the use of banding in education (Anderson and Spreyer 1982), and another gave their recommendations for how to offer a bird banding talk (Hansrote 1992, 1996). Neither conducted comprehensive education research.

The lack of evaluation literature related to bird education, paired with the great magnitude of programs largely believed to be effective, illustrates a need to understand how these programs impact learners. Program evaluation provides an opportunity to further build on efforts by Pitkin (2005) in creating a manual for banding education providers. Through research such as we present here, we can continue to refine the best practices for banding education in meeting shared goals. Findings from an evaluation of one organization's program can offer lessons and suggestions to providers broadly.

In 2007, Klamath Bird Observatory (KBO) began a comprehensive evaluation of its bird banding education program to determine how effective this program is in meeting bird conservation education goals. KBO is a conservation focused nonprofit organization that emphasizes observation-based science and additionally relies on education for achievement of conservation goals. As such, KBO's mission is to advance bird and habitat conservation in the Americas through science, education, and partnerships. KBO works regionally in the Klamath-Siskiyou Bioregion of southern Oregon and northern California and internationally in Latin America where many of the bioregion's neotropical migrants spend their winter. KBO strives to meet the education aspect of their mission through a variety of education programs serving land managers and private land owners, birders, community members, K-12 students and teachers, young biologists and environmental educators.

KBO identified the need for a program evaluation plan for their longest standing and most comprehensive school offering—Songbirds, Science, and Schools—which provides a field trip to a mist netting station. Without evaluation, the impacts this program had on its learners were unverified. With no other bird education research to draw from, KBO could not gather recommendations on program design from previous research. KBO also needed evidence to show their program was meeting its goals and objectives to satisfy increasing accountability demand from funders as this program relies heavily on foundation support. To determine the effectiveness of this bird education program, this study evaluated whether it met its goals and objectives, which specifically examined whether the program increased 4/5th grade students' science and bird-related knowledge and skills, awareness of birds, and conservation behavior intentions.

METHODS

Program Description

KBO's educational offerings are guided by the strategic goal to "educate about birds, their environments and the link between science and conservation." The Kindergarten-12th grade (K-12 or ages 5 to 18) education programming is further guided by the goal "to increase K-12 grade students' awareness and knowledge of birds, nature, and conservation while increasing interest in birds, science, and stewardship" (Dayer 2007). Songbird, Science, and Schools is offered to K-6th grades and falls under this K-12 education programming goal. Additionally, Songbird, Science, and Schools goals are 1) to provide education opportunities with hands-on activities and guided field study, 2) to increase awareness and knowledge of birds and conservation of their environments, and 3) to support science education in local schools.

These goals are followed by the objectives which state that the project will enhance teachers' abilities to meet science curriculum goals according to Oregon Department of Education

Standards (Oregon Department of Education 2008); provide a quality educational experience for students and teachers; expose students to birds and their environments in the classroom and the outdoors; incorporate the most recent ornithological knowledge in an age-appropriate manner; and increase student interest in protecting birds and their environments. KBO has created different classroom and field lessons for K/1st, 2/3rd, and 4/5th grades. For each, the instructional goals and objectives and the Oregon science state benchmarks are stated in the lesson. Specifically for the 4/5th grade lessons, the program strives to meet Oregon life science and scientific inquiry curriculum goals.

Songbirds, Science, and Schools begins with a 60- to 90-min classroom lesson with a presentation and hands-on activity. Then students take a morning field trip that includes a 75-min structured visit at an ecological monitoring station where KBO bands songbirds, followed by a bird walk for another 75-min. Teachers are provided with an optional post activity to analyze and discuss data collected on the field trip. Lessons and activities vary due to age level in order to have meaningful age-appropriate science lesson. Our 4/5th grade classroom visit allows students to explore study skins of local birds and teaches ornithological skills of field sketching, field mark identification, field guide usage, and hypothesis development. The field visit provides students the chance to test their hypotheses as to whether their birds will be found in the field trip habitat at this time of year, recording all birds captured at the ecological monitoring station and seen with binoculars.

Participants

All 4/5th grade classes who signed up for KBO's Songbirds, Science, and Schools program for the fall 2007 participated in this study. The population included 11 teachers and 284 students. The classes came from three southern Oregon school districts: Ashland (n = 2), Medford (n = 6), and Phoenix-Talent (n = 3). Three out of the 11 classes were 4th grade (28.5% of the student participants) while the remainder were 5th grade classes (71.5% of the student participants). Gender was equally represented in student participants with 48.9% girls and 49.6% boys and 1.5% unidentified. All except two classes came from Title 1 schools, which is defined as more than 35% of the student body comes from low-income families that have children eligible for a free or price-reduced school lunch.

Four out of the 11 teachers were male, and three of the teachers had participated in the program previously. Their years teaching varied from one to 24 years, with the average being 13.6 years. On average, the teachers participated in six field trips or nature-oriented class visits per year. At the time of this study, KBO was either the first or second field trip for the school year for the participating classes. Even though the teachers had plans to expose students to various nature-oriented activities and learning for the school year, most students had not yet been exposed to these other programs at the time of this study.

Evaluation Approach and Design

The evaluation of the Songbirds, Science and Schools program for 4/5th grade classes followed a goal-oriented approach, which allowed us to assess its achievement of goals and objectives. A goal-oriented approach which is also known as an objectives-outcomes approach, examines short, medium, and long-term outcomes as a result of program participation (Posavac and Carey 1997, Weiss 1998, Patton 2002). Outcomes refer to participant learning, actions, and conditions the program wants participants to achieve. In using the goal-oriented approach, we also considered why the program succeeded or failed in meeting its goals and objectives and whether the goals are the best ones for the program and people served (Weiss 1998). Participation by students and teachers in the evaluation research process allowed for different perspectives on how well the program met its goals and objectives.

We employed a concurrent mixed-method data gathering technique to capture how the program meets its goals and objectives (Creswell 2003). This approach involves both quantitative and qualitative techniques simultaneously during data collection, and increases confidence in the validity of results by combining the strengths and correcting the deficiencies of any one data source (Patton 1987, Weiss 1998, Creswell 2003). For example, surveys were used to measure the relationship between the program and students' knowledge, awareness and behavior. At the same time, we further explored this relationship using interviews and observations. The evaluation instruments we included in the mixed-method approach were observations, surveys, and interviews.

The observations assessed if students were increasing their knowledge and awareness of birds and developing science skills during the class and field visits and transferring their knowledge, awareness, and science skills between the class and field visit. The observations also assessed if students were increasing

their intentions to protect birds by watching student behavior and listening to their comments during the class and field visit. The observations were recorded as free-form notes filled out during the classroom and field trip visit. We observed the lesson and helped the instructor by passing out materials and guiding students during the independent activities as an overt, participant observer. We informed teachers about the observer both in the sign up and confirmation letter. The observations allowed us to use an open-ended technique to capture unplanned results (Bennett 1977). The class and field visit observations also provided us with the opportunity to watch how the program functions compared to the lesson plans. Seeing the program in action gave insight as to how the program is delivered and what information is actually conveyed to the students.

Student surveys were another method to determine if students were increasing their knowledge and awareness of birds, developing science skills and increasing their intentions to protect birds covered by the program. The student surveys involved a pre-test, post-test, and follow-up post-test. This design involves evaluating a single group before and after the program to see if participant knowledge, attitudes, skills, awareness, and actions improve as a result of being involved with the program (Posavac and Carey 1997, Weiss 1998).

The single-group pre-test–post-test evaluation design has been used extensively and with success in a variety of settings including education, health-care, and political campaigns (Weiss 1998). We incorporated an additional post-test to determine long-range implication of the program in meeting its goals, which few evaluation studies do. Student surveys were designed for this program and were pilot tested in spring 2007. Student's age, development stage, and reading ability influenced the format and style of questions included in the survey. We designed the student surveys to reflect cognitive and social development, as stressed by Borgers and de Leeuw (2000).

Teachers administered the surveys. The pre-test surveys were sent to them one week prior to the classroom visit and administered one to two days prior to the class visit. The post-test surveys were given to the teachers during the field visits and administered one week after the field visit. The three month follow-up surveys were mailed to teachers and administered at that time. Each time teachers received the student surveys, they also received a letter describing the evaluation research and instructions for administering the test. We collected the surveys either during the class visit or interview or had them returned in the mailed. We sent email reminders to the teachers about administering the surveys.

Students were asked a series of questions to assess their increase in awareness of birds, knowledge on birds, and their intention to protect birds. The surveys included a series of four "yes" or "no" questions, two rating scale questions, four multiple choice questions, and three fill-in the blank questions to assess their awareness and to test their knowledge (Appendix A). The questions were the same between pre-, post-, and follow-up student surveys but the questions were rearranged in a different order between the three tests to limit testing familiarity.

In addition, students were asked to respond to six statements on a five-point Likert-type scale (Babbie 2004) from "definitely not" to "definitely yes" to assess their intentions about protecting birds. An open-ended question was added to the post-test surveys asking the students to share one thing they learned during the KBO visit, allowing them to express in their own words what they learned. This combination of open- and closed-ended questions allowed for the assessment of increases in students' knowledge, awareness, and behavior intentions related to the program's goals and objectives.

Teacher surveys asked questions related to achievement of goals of the program, program's ability to meet science standards, quality of program, and effectiveness of approach. These surveys included a series of seven-point Likert-type scale statements from "strongly disagree" to "strongly agree". Each section of the Likert-type scale statements was followed by an open-ended question allowing teachers to comment further on the topic. Teachers received the surveys on the day of the field trip and completed them one week after the field visit as the students completed their post survey.

Teacher interviews also measured if students increased their knowledge and awareness of birds, developed science skills, and increased their intentions to protect birds and their environments. In the interviews, teachers provided details about their perceptions of the program, specifically what they thought their students gained from the program and how the program influenced student intentions to protect birds and their environments. Face-to-face interviews were conducted generally in their classroom, one to two weeks after the field visit. The interviews followed an open-ended semi-structured format, using the same questions for each interview (Monroe 2002, Patton 1987). For the teacher interviews, verbal consent to tape and take notes was asked prior to recording. We reviewed the recording and typed up the notes.

Statistical Analyses

Each evaluation instrument and participant population was analyzed separately, using appropriate techniques for the instrument. All statistical analyses were conducted using SPSS 16 (SPSS 2008). Then, we compared the findings from various instruments. We analyzed the interviews and observation notes for emergent themes by reading and rereading notes for theme clarification.

For the student surveys, we compared individual students' knowledge and awareness of birds and students' intentions to protect birds between the pre-test and post-test. We also examined if students maintained their knowledge three months later. Two classes were unable to administer the pre-test due to issues with postal delivery and some students were absent for student survey administration for one of the three tests. These students were removed from the analysis, thus reducing the population size. This made the population of students for analyses of knowledge assessment 190, of awareness assessment 211, and of conservation intention assessment 203.

To determine if students increased their knowledge about birds and science skills after the program, we ran a repeated measures ANOVA across all three student surveys for each of the six knowledge questions with a 95% confidence interval at the level of significance ($P \leq 0.05$) by comparing the increase in correct answers. For the awareness question, "Do you spend time watching birds," we ran a two-tailed *t*-test between the pre-test and post-test survey with a 95% confidence interval at the level of significance ($P \leq 0.05$) and tested if students increased their awareness of birds after the program.

We also ran a two-tailed *t*-test between the pre-test and post-test survey for the conservation intention statements with a 95% confidence interval at the level of significance ($P \leq 0.05$). We then measured students' bird conservation intentions using an index comprised of six statements addressing bird conservation actions students could take. Students responded to each item on a 5-point bipolar scale ranging from +2 (definitely yes) to –2 (definitely not). The index scale exhibited acceptable internal consistency for both pre- and post-test (pre-test Cronbach's alpha = 0.81; post-test Cronbach's alpha = 0.88). A comparison of scores on the conservation index two-tailed *t*-test between the pre-test and post-test survey with a 95% confidence interval at the level of significance ($P \leq 0.05$) allowed us to determine if students increased intentions to protect birds and their environments after the program.

We also examined the open-ended question of "write one thing you learned from the KBO visit" in the post-test survey to determine if they increased their knowledge, awareness, and behavior intentions from the program. We classified responses into emergent themes by reading and rereading responses to clarify themes. The analysis included 274 students who answered this question.

We analyzed the teacher surveys using means and frequencies of the Likert-type scale responses. Then, we compared the supporting open-ended comments from the surveys to the scale responses. For the teacher interviews, we identified emergent themes from the notes, which represented ideas expressed by teachers on what the students gained from the program and how the program influenced students' intentions to protect birds and the environment.

RESULTS

Our results indicate that there was knowledge gained, science skills demonstrated, and an increased awareness of birds from the program. Yet, our results did not conclusively show an intention to protect birds following participation in the program. The surveys and interviews were inconsistent in their agreement on whether the program increased intention to protect birds, and we did not observe students discussing actions for protecting birds.

Knowledge and Skills Objective

Student surveys, teacher surveys, and interviews all demonstrated students increased their knowledge on birds and developed science skills. Student surveys demonstrated knowledge and skill gained from the pre-test to post-test and that knowledge and skill were maintained three months after participating in the program (Fig. 1). For each student survey question, the proportion of correct answers increased from before to after participation in the program. The proportion of correct answers remained the same after three months for five of the six questions.

For example, the proportion of correct answers increased from 0.39 to 0.82 in recognizing that field marks are used in identifying birds, and the proportion of correct answers stayed at 0.82 three months later. Students' ability to determine the time of year a bird is found in their area using a range map also increased from 0.63 to 0.90 and remained at 0.92 three months later. The one exception was students' ability in recalling the term "ornithologist." It first increased from 0.16 to 0.53 but declined in recalling this term three months later to 0.38.

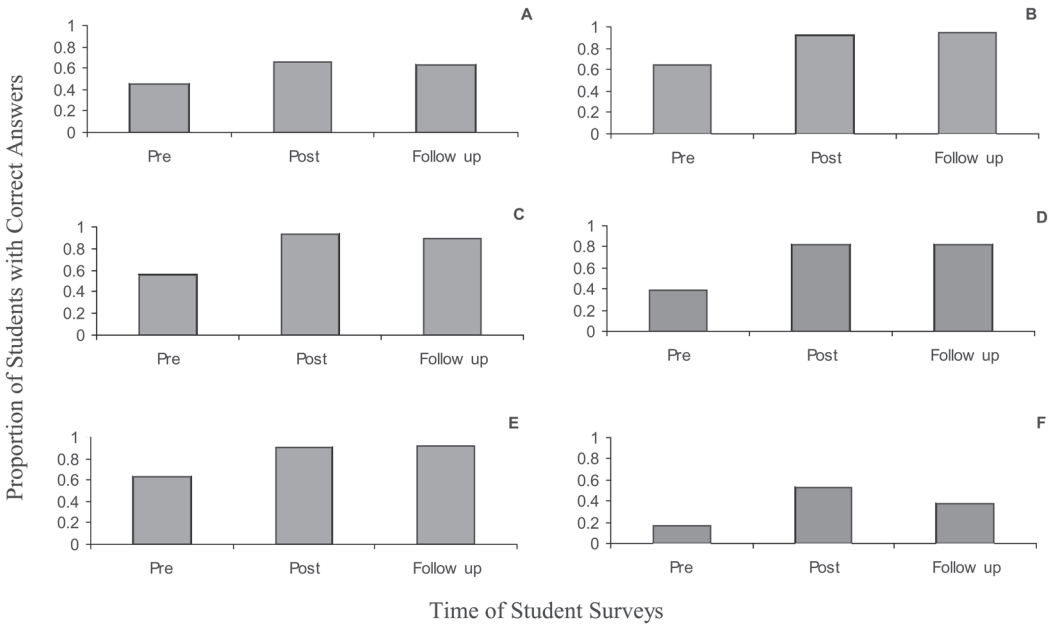

FIGURE 1. Comparison of proportions of correct answers on knowledge questions pre, post, and three months follow up. For each question, $P \leq 0.001$; repeated measures ANOVA ($n = 190$). The knowledge questions represent: A = A bird with a cone bill eats; B = When out bird watching, what book would you use to figure out what birds you are seeing?; C = The scientist at the banding station use what tool to capture birds in?; D = What clues would you look for on a bird to help you the best to figure what type of bird it is?; E = What time of the year would you find Pine Siskins in Ashland?; F = A scientist who studies birds is called.

For the open-ended question "write one thing you learned during the KBO visit," 75% of the responses expressed a knowledge related theme (Table 1). Knowledge responses were defined as those where students wrote about bird biology, ecology, and banding information and/or skill they gained during the KBO visit like "you can identify birds by field marks" and "birds with cone beaks eat seeds." 59% of the knowledge responses were about the banding process like "they have almost invisible nets to capture the birds in." From their own words and the standardized questions, the student surveys suggest student knowledge related to birds increased as a result of the program.

Teacher surveys and interviews corroborated the student survey results (Table 2). On average teachers strongly agreed that student knowledge increased and students developed stronger science skills. Only for the item measuring whether KBO's education program increased graphing skills was the average response "slightly agree". This skill was part of the post activity, and four teachers did not conduct the post activity with their students. One teacher described the challenge in using the post activity as "they only netted 3 birds and it was hard to do much work with that little of data."

During the interviews, most teachers agreed that the program taught students a new skill. The emergent themes from the interviews on new skills were students learned to observe birds, to use field guides as references, or to organize and collect data. Six teachers expressed how important the observational piece was in the students' learning: "the hardest thing for a 5th grader in scientific inquiry is to observe. This really taught them patience in observation and recalling what you saw in detail. Developmentally it is really hard for them. They want immediate results. The program taught them to take time, to have a keen eye, and to record the details."

Three teachers discussed how the program taught them how to use field guides, and two teachers shared how the program taught students how to organize and collect data. "I was really impressed with recording data and organizing it in a system from the charts you had them fill out and classifying the data." Teacher surveys and interviews demonstrated teachers agreed the program increased student knowledge and developed science skills in observation and data collection.

Likewise, the observation results indicated students gained knowledge on birds and demonstrated science skills. Every class demonstrated

TABLE 1. Sample student responses to the open-ended question on what they learned when asked (N = 274).

Categories	Definitions	Responses
Knowledge	Responses on bird biology, ecology, and banding information and/or skill they gained	• I learned that if a bird has a long tweezers bill it eats insects. • The birds focus on their perch and accidently hit the net. • I learned about when certain birds are around in certain places because of their migration.
Enjoy	Responses on how they liked watching birds	• I learned that bird watching is fun. • I learned how neat it is to watch birds and study them like we did.
Importance	Responses on why they thought birds are important	• I learned that birds are very special and that there are a lot of dangers for birds. • Birds are vey delicate!

Table 2. Teachers' agreement to songbirds, science, and schools program meeting student goals on knowledge, awareness, science skills, and protecting birds (N = 11).

Survey Question	Mean[1]	Range
Students' Awareness of Birds	7.0	7
Students' Knowledge of Birds	6.7	6-7
Students' Interest in Protecting Birds	6.5	6-7
Students' Science Skills in Data Collection	6.6	5-7
Students' Science Skill in Graphing	5.9	4-7
Students' Science Skill in Data Analysis	6.2	5-7

[1]Items were measured on a 7 point scale from 1 "strongly disagree" to 7 "strongly agree".

transference of knowledge learned from the classroom to the field visit. All classes correctly identified bird beak shapes and field marks during the field visit. Many classes also demonstrated the ability to classify the bird to the appropriate bird family, especially for sparrows, finches, and warblers. Students who had participated with KBO during the previous spring remembered several details on the banding process like "you need to check the nets every 20 minutes for bird safety."

We also observed that 90% of the students in six classes completed their worksheets on field sketching, field guide investigation, and hypothesis development during the classroom visit, while in the other five classes 50% of the students completed their worksheets. This may have been due to lack of time to fully complete the lesson since these classes had a shortened lesson due to the school's schedule. For the field visit, all 11 classes wrote their hypotheses and completed their data tables.

Awareness Objective

Results also demonstrated students increased awareness of birds in their environment. From the student surveys, more students indicated spending time watching birds after the program, increasing from 44% to 50% (P = 0.02). For the open-ended question "write one thing you learned during the KBO visit," 2% of the responses related to enjoying watching birds (Table 1). Similarly, in teacher surveys, all 11 teachers responded "strongly agree" when asked if they agreed that KBO's education program increases students' awareness of birds (Table 2). Ten teachers during their interviews stated this program increased awareness and appreciation of birds. "We go on walks every morning to the park across the way. They want to know what birds are flying by, and I say I don't know. Let's look it up when we get back. It heightened their curiosity about birds, before it was just a bird." In observation data, we observed that students in six classes were aware of birds in the environment by pointing them out to KBO instructors during the field visit.

Conservation Intention Objective

Results were inconsistent in determining whether students increased their intentions to protect birds and their environments. Results of the t-test comparing pre- and post-conservation index values showed that there was no increase in behavior intention (P = 0.84, t = 0.20). For the open-ended question "write one thing you learned during the KBO visit," 8% related to the importance of birds (Table 1). The importance of birds responses were defined as those where students wrote about how sensitive birds are and why they need protection and dangers they

face. In contrast, teachers agreed on surveys that the program increased students' intention to protect birds. However, in their interviews most teachers struggled to offer specific examples of students intending to protect birds. Yet, they still believed the program influenced students' intentions to protect birds and their environments because the students were more aware of birds.

One teacher shared "any time kids understand about things they are more apt to protect things they understand." Only one teacher gave a specific example of student behavior protecting birds, "we had a discussion from picking up litter around the school grounds. I asked why it is important. They brought it right back. The birds could eat the garbage and get sick. They tied it together on keeping our environment clean for the animals." In our observations of the class and field visit, we did not witness actions that would help birds or hear comments from students about why it is important to protect birds or what they could do to protect birds. We also noticed a lack of delivery on the message of how KBO links science to conservation and why it is important to study birds for bird and habitat conservation during the field visit.

DISCUSSION

Our results show that Klamath Bird Observatory's banding education program clearly meets its goals to enhance students' knowledge of birds and science, science skills, and awareness of birds but does not conclusively increase students' intention to protect birds and their environment. Unlike the knowledge, skills and awareness outcomes, results from student surveys and observations conflicted with teacher surveys and interviews related to the conservation behavior intention outcomes. Teachers could not give specific examples of student conservation behavior based on their observations and they also mentioned that KBO did not really cover bird conservation issues during the program, which was confirmed by the observations that the KBO instructor rarely, if ever, discussed bird conservation issues and why they are important and why this research is vital to bird survival. These conservation messages should have been included by the instructor as they are stated in the lesson plan, which could refer to a quality issue of not following the lesson plan. Another factor that could have affected not meeting this outcome is the banding education program does not allow students to discover bird conservation issues in a hands-on manner as it does science and awareness of birds. Incorporating a hands-on conservation-learning activity could enhance conservation outcomes.

Misconceptions held by teachers may have also led to the conflicting results about the achievement of conservation outcomes. Teachers often believe in the misconception that once you know more and are more aware of something you are going to protect it (Hines and Hungerford 1984). This was confirmed by interview responses and teacher survey agreement that program did increase student intention to protect birds. The knowledge, awareness, behavior model is too simplistic and research shows that this model does not work in creating changes in behavior (Hines and Hungerford 1984, Hungerford and Volk 1990, Marcinkowski 2005).

Rather, the research has shown that curriculum that builds from ecological knowledge, to awareness to issues and values, to investigation and evaluation of issues, to environmental action skills and provides an instructional setting that reinforces these skills creates a more environmentally inclined person, which was labeled Investigating and Evaluating Environmental Issues and Actions (IEEIA) (Ramsey et al. 1981, Ramsey and Hungerford 1989, Ramsey 1993, Hungerford et al. 2000). Accomplishing such curriculum design like IEEIA (Hungerford et al. 1988) can be extremely challenging for a one-time program and not all levels of the curriculum are the most appropriate for 4/5th graders. Volk (2005) recommended during grades 3rd to 6th to focus on ecological foundations and issues/values. This program does teach ecological foundations of interdependence but lacks the issues/values.

KBO is currently determining how to strengthen the conservation message for the activities to achieve the stated lesson plan. As such, this evaluation has further benefited KBO as it has allowed the organization to be more adaptive in their educational strategies. Evaluation also provided KBO with a better picture of what the program is actually achieving and the impacts it is having on the learners. Without evaluation, KBO would be under the assumption from its anecdotal feedback and teacher surveys that this program is meeting its conservation-based goal and objectives. Rather, the evaluation results have provided an opportunity to strengthen Songbirds, Science, and Schools to fully meet these goals. KBO plans to track results on student outcomes and teacher needs as the organization changes and adapts their program. This will allow for monitoring change and further exploring what contributes to program success.

Even though it did not conclusively meets its conservation goal for the program, this evalu-

ation study demonstrates the program is successful in meetings its knowledge, skill, and awareness goals. From this study, KBO can clearly state that it meets the shared goal of inspiring bird appreciation. Through continued evaluation efforts, we will continue to learn what contributes to meeting the shared goals of educating about conservation, and demonstrating the link between science and conservation.

Yet, further studies on bird education programs also need to occur. We do not know how other bird education programs impact learners and what goals they achieve, especially for different age groups and non-bird banding programs. We recommend evaluation studies be expanded to other organizations whose education programs focus on birds and bird conservation. By collectively exploring variables that lead to success of program design, we can begin to understand what learning processes would be best to teach about bird conservation and how different programs meet our shared goals and the impacts we are having on learners. We recommend evaluation become more integrated into program development and organizational culture to understand how our bird education programs actually work and to also contribute to the growing understanding of how bird education can contribute to bird conservation success.

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APPENDIX A

Klamath Bird Observatory's Post-test Student Survey

Check the best answer for questions 1-4:

1. Do you spend time watching birds (not including the field trip)?

☐ Yes ☐ No

2. Do you know the names of most birds you see?

☐ Yes ☐ No

3. Do you have bird feeders at your house?

☐ Yes ☐ No

4. Have you ever gone on a field trip to watch bird banding?

☐ Yes ☐ No

On a scale of 1–10, rate the following questions by ***circling ONE number****.*

5. How much do you know about birds?

Little				Average					Lots
1	2	3	4	5	6	7	8	9	10

6. How much do you like watching birds?

Little				Average					Lots
1	2	3	4	5	6	7	8	9	10

Circle the best answer for questions 7–10:

7. A bird with a cone bill (like the one shown) eats

a. Insects
b. Seeds
c. Mice
d. Worms

8. When out bird watching, what book would you use to figure out what birds you are seeing?
   a. Dictionary
   b. Science book
   c. Text book
   d. Field Guide
9. The scientists at the banding station use what tool to capture birds in?
   a. A mist net
   b. A snare
   c. A trap
   d. A hoop net
10. What clues would you look for on a bird to help you the best to figure what type of bird it is?
   a. Habitat
   b. Flying
   c. Field marks
   d. Age

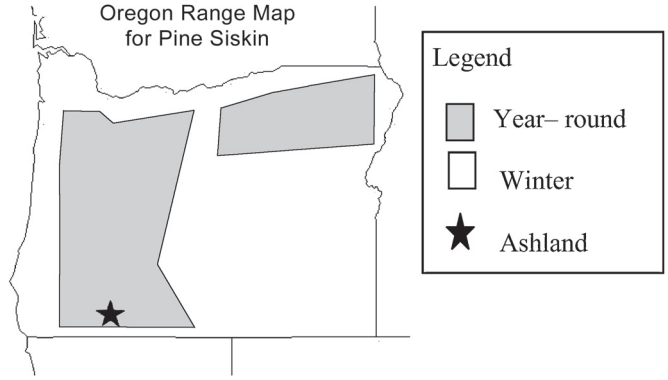
F*ill in the blank for questions 11 and 12:*

11. A scientist who studies birds is called _____.

12. Give one example of a bird that lives near your school _____.

For questions 13, use the map below to fill in the answers.

13. What time of the year would you find Pine Siskins in Ashland?
_____



Check the answer that best matches your feelings for the following statements. ***Check only ONE per statement.***

14. I would tell other people why birds are important.

☐ Definitely not! ☐ Probably not ☐ Maybe ☐ Probably yes ☐ Definitely Yes!

15. I would tell my family one thing they can do to protect birds.

☐ Definitely not! ☐ Probably not ☐ Maybe ☐ Probably yes ☐ Definitely Yes!

16. I would watch birds for fun.

☐ Definitely not! ☐ Probably not ☐ Maybe ☐ Probably yes ☐ Definitely Yes!

17. I would learn more about birds for fun.

☐ Definitely not! ☐ Probably not ☐ Maybe ☐ Probably yes ☐ Definitely Yes!

18. I would tell some one to stop hurting a bird if I see it.

☐ Definitely not! ☐ Probably not ☐ Maybe ☐ Probably yes ☐ Definitely Yes!

19. It would make me sad to find a dead bird.

☐ Definitely not! ☐ Probably not ☐ Maybe ☐ Probably yes ☐ Definitely Yes!

20. Write one thing you learned during the KBO visit.