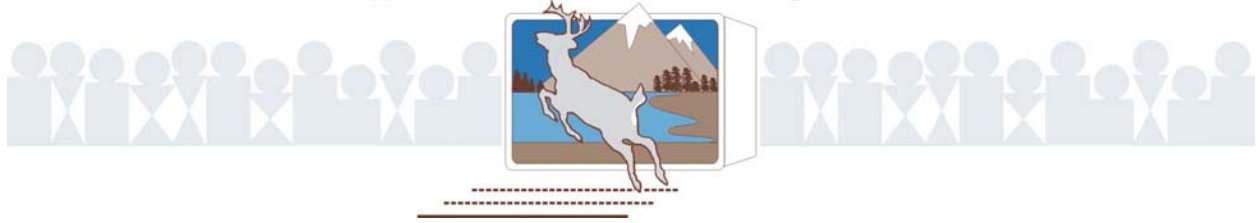


# Responsive Management



## **AN ASSESSMENT AND EVALUATION OF THE NATIONAL ARCHERY IN THE SCHOOLS PROGRAM**

### **PHASE IV: FINAL REPORT**

**Conducted for the National Archery in the Schools  
Program Foundation**

**by Responsive Management  
in cooperation with Hilarie Davis, Ed.D.**

**2009**

**AN ASSESSMENT AND EVALUATION OF THE NATIONAL  
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**Responsive Management National Office**

Mark Damian Duda, Executive Director  
Martin Jones, Senior Research Associate  
Tom Beppler, Research Associate  
Steven J. Bissell, Ph.D., Qualitative Research Associate  
Andrea Criscione, Research Associate  
James B. Herrick, Ph.D., Research Associate  
Joanne Nobile, Research Associate  
Amanda Ritchie, Research Associate  
Carol L. Schilli, Research Associate  
Megan Wilkes, Research Associate  
Tim Winegord, Survey Center Manager  
Alison Lanier, Business Manager

130 Franklin Street  
Harrisonburg, VA 22801  
Phone: 540/432-1888 Fax: 540/432-1892  
Email: [mark@responsivemanagement.com](mailto:mark@responsivemanagement.com)  
[www.responsivemanagement.com](http://www.responsivemanagement.com)

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## **EXECUTIVE SUMMARY OF FINDINGS**

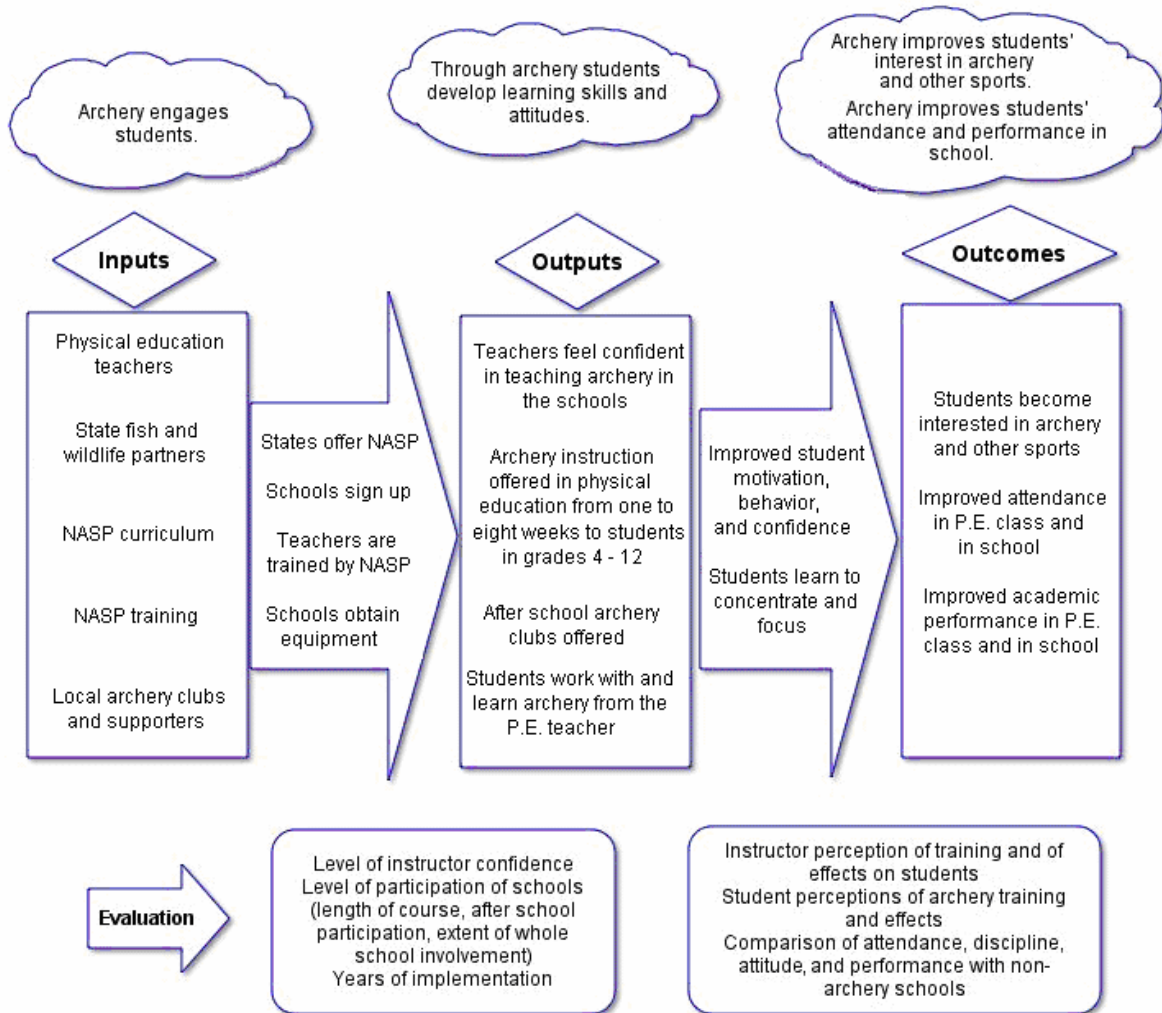
The National Archery in the Schools Program (NASP) is a joint venture of state departments of education, state fish and wildlife agencies, archery equipment manufacturers, and archery organizations with a dual mission of promoting student education and lifelong interest and participation in the sport of archery. The program was developed to provide international-style target archery training through a standardized education package that can be directly incorporated into schools' physical education (P.E.) curriculums.

Part of the importance of the NASP is that it helps school children become more active. A review of past research has bearing on this subject and suggests that physical activity may benefit academic performance. The consensus is that physical activity, including physical education (P.E.) in schools and students' participation in sports, has a beneficial effect on students' attitudes and self-confidence, which leads to improved academic achievement. Research also suggests that participation in physical activities is positively associated with a student's self-esteem and emotional well-being.

Building on this review of past research regarding physical activity (including P.E. and sports participation) and academic performance discussed above, researchers hypothesize that the NASP has a positive effect on overall academic performance of students. Specifically, researchers hypothesize that learning archery is engaging to students; that archery participation improves learning skills and attitudes; and that archery positively affects students' attendance and performance in school. It is also conjectured that the archery program increases students' and their families' interest in archery and other sports.

These hypotheses are contained in the NASP Logic Model (shown on the following page) that was developed to show the intended inputs, outputs, and outcomes of the NASP. The outcomes depend, in part, on the hypotheses, which are also shown in the NASP Logic Model. Finally, the NASP Logic Model includes the evaluation parameters to be studied.

### National Archery in the Schools Program Logic Model



### National Archery in the Schools Program Logic Model

The evaluation of the NASP and its effects on student attendance and academic achievement, as well as its effects on student and family interest in archery, was completed in three phases:

- Phase I: A survey of NASP instructors regarding their observations and perceptions of the effects of the NASP
- Phase II: A survey of students who participated in the NASP and students who did not participate in the NASP
- Phase III: An analysis of student grades to assess student performance as it related to NASP participation

The data obtained in this project show positive results regarding three of the four hypotheses. Hypothesis 1, which states that archery is engaging to students, is clearly supported by the student and instructor surveys. In short, nearly all measures of engagement show that students are, indeed, engaged by the archery program.

Hypothesis 2, which states that the NASP helps improve students' learning skills, in and outside of P.E., is also fairly well supported by the data. The data show that students' self-confidence is certainly improved. Students also feel that they learn to concentrate and focus better, which carries over into other aspects of their academic experience. The evidence suggests that they are more motivated in school, as well. Based solely on Hypothesis 2, it would appear that the NASP is beneficial to students.

The results for Hypothesis 3, which states that the NASP increases students' interest and involvement in archery, which in turn also increases family interest, suggest that students' interest in archery is increased. Additionally, it appears that their interest in other shooting sports is increased. Based on the link between physical activity and a well-rounded academic experience that the review of past research demonstrated, this increased interest in archery and shooting sports could have a potentially beneficial effect on students. On the other hand, family interest in archery does not appear to be greatly affected by students' participation in archery, although there is a small increase in family interest.

The data on Hypothesis 4 are inconclusive. While it appears that students have better attitudes toward school as a result of the NASP—which one would intuitively think would lead to better attendance in the long run—the data do not show a statistically significant link. Nonetheless, the positive results in self-reported attendance and academic performance because of the NASP suggest that further study be conducted before any definitive statement can be made on the effect that the NASP has on attendance and performance. Certainly, a better attitude among students can only help with attendance and academic performance.

Overall, the study indicates that the NASP has many benefits for schools. Three of the four hypotheses are well supported, and there are some positive results regarding some elements of the fourth hypothesis. It would appear that the program proves its value based simply on having the second hypothesis supported alone. The fact that three of the four hypotheses are supported by the data, and that the fourth has positive results regarding some elements, is compelling evidence of the overall value of the program. Furthermore, it is worth noting that the fourth hypothesis was not *disproved*, as it had mixed results, including some quite positive results regarding some of its aspects—including the fact that students appear to have a better attitude about school itself.

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## **I. INTRODUCTION AND BACKGROUND**

### **Background of the National Archery in the Schools Program**

The National Archery in the Schools Program (NASP) is a joint venture of state departments of education, state fish and wildlife agencies, archery equipment manufacturers, and archery organizations with a dual mission of promoting student education and lifelong interest and participation in the sport of archery. The program was developed to provide international-style target archery training through a standardized education package that can be directly incorporated into schools' physical education (P.E.) curriculums. Since its inception, the NASP has been implemented in over 4,700 schools and has generated interest in 29 other countries, including Spain, the UK, Ireland, Morocco, Japan, Finland, Australia, South Africa, New Zealand, Switzerland, France, and others. Closer to home, the NASP has helped educators in Mexico and the Canadian provinces of Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, Ontario, Quebec, and Saskatchewan.

While the link between the NASP and the promotion of interest and participation in archery is intuitive, the link between the NASP and the promotion of student education is less straightforward. This latter link depends on a possible correlation between physical activity and academic achievement. While this study seeks to assess that possible link, a review of past research has bearing on this subject and suggests that physical activity may benefit academic performance.

### **Effect of Physical Activity on Measures of Academic Performance**

The effect of physical activity in a student's overall academic experience has been extensively studied in the past several years, prompted in part because of school systems' limited funding, the increased demand to meet scholastic standards, and curriculum time constraints. The consensus is that physical activity, including physical education (P.E.) in schools and students' participation in sports, has a beneficial effect on students' attitudes and self-confidence, which leads to improved academic achievement. As Masurier and Corbin (2006) explain, "Quality physical education provides students with many real-world skills in addition to providing regular physical activity in the school day. Among the most important of these skills are self-management skills that help youths adopt healthy living practices and manage their day-to-day activities" (p. 47).

Numerous studies offer extensive evidence of a correlation between physical activities and overall academic performance, including higher scores on standardized tests (Ahamed et al., 2007; Shephard et al., 1984), higher grades (Coe, Pivarnik, Womack, Reeves, & Malina, 2006; California Department of Education, 2003; Field, Diego, & Sanders, 2001; Williams, 1988), and better ratings of performance (as rated by principals) in school (Dwyer, Sallis, Blizzard, Lazarus, & Dean, 2001). While many of these studies note that a causal relationship is indeterminable, the studies suggest that a correlation between physical activity and academic performance exists—that participation in physical activities is part of a well-rounded set of positive behaviors linked to good academic performance.

In addition to studies exploring the effect of physical activity on pedagogical measurements, many studies consider the influence of physical activity on more subjective determinants of academic performance, including attitudes and behavior, self-esteem/self-efficacy, concentration and cognition, and personal relationships. In a study of student participation in school sports and its relationship with student behavior, Harrison and Narayan (2003) suggest that students involved in sports or other extracurricular activities are more likely to practice healthy behaviors, to have a positive self-image, and to have a decreased tendency toward emotional distress. They also have lower incidence of substance abuse and participation in illegal activities. There have also been several studies that indicated that there are beneficial effects of exercise on individuals with mental, emotional, and behavioral problems (Allison, Faith, & Franklin, 1995; Bosscher, 1993; Evans, Evans, Schmid, & Penneypacker, 1985). In addition to the effect that physical activity has on grade point average (GPA), Field, Diego, and Sanders (2001) also suggest that students with better exercise habits demonstrate higher levels of intimacy with their parents.

Research also suggests that participation in physical activities is positively associated with a student's self-esteem and emotional well-being (Yu, Chan, Cheng, Sung, & Hau, 2006; Nelson & Gordon-Larsen, 2006; Frost & McKelvie, 2005; Tremblay, Inman, & Willms, 2000), self-concept and/or body image (Kirkcaldy, Shephard, & Siefen, 2002; Hausenblas & Symons Downs, 2001; Alfermann & Stoll, 2000), and sense of belonging and school connectedness (Brown & Evans, 2002). There also appears to be a significant link between physical activity and improved concentration and cognition (Sibley & Etnier, 2003; Tomporowski, 2003; Caterino & Polak, 1999; McNaughten & Gabbard, 1993).

Further research evinces the importance of physical activities to self-regulation and self-efficacy. Self-regulation in P.E. has long been the subject of research and has been touted as an important component in successful athletic sports and physical education curricula. According to Davis and Davey (2006), effective self-regulation requires, throughout the learning process, that students have clear goals; that they observe themselves; that they judge their progress as they go; and that they hold positive beliefs about their capabilities, the value of learning, the factors influencing learning, and the anticipated outcomes. Due to the use of a strategy in sport activities and the directed aim to reach a particular goal, the practice of self-regulation is particularly advantageous in sport participation and physical activities.

Studies have shown that self-regulation and self-monitoring appear to impact sport confidence (Vealey, Hayashi, Garner-Holman, & Giacobbi, 1998); perception of mastery and success (Kim, 1999; Kim & Cho, 1996); and increased skill performance in a number of sports, including golf (Beauchamp, Halliwell, Fournier, & Koestner, 1996; Kirshenbaum & Bale, 1984), soccer (Brunelle, Janelle, & Tennant, 1999), and swimming (Anshel & Porter, 1996; Bell & Patterson, 1978). Prapavessis, Grove, McNair, and Cable (1992) completed a case study of the effects of self-regulation on a small-bore rifle shooter to explore whether self-regulation techniques would result in a reduction in anxiety. In addition to finding a positive effect on anxiety reduction, the study also suggests that these techniques increased self-confidence and performance. Although these are subjective determinants of performance as a whole, the findings suggest that these factors have an impact on skill levels, perceived abilities, and information processing, all of which impact student achievement. The question remains: Do these results translate to the

specific sport of archery or archery as a curriculum in P.E. class? And, even more importantly, are the skills learned in archery transferable to other subjects and areas of learning?

### **Effect of Target Sports on Measures of Academic Performance**

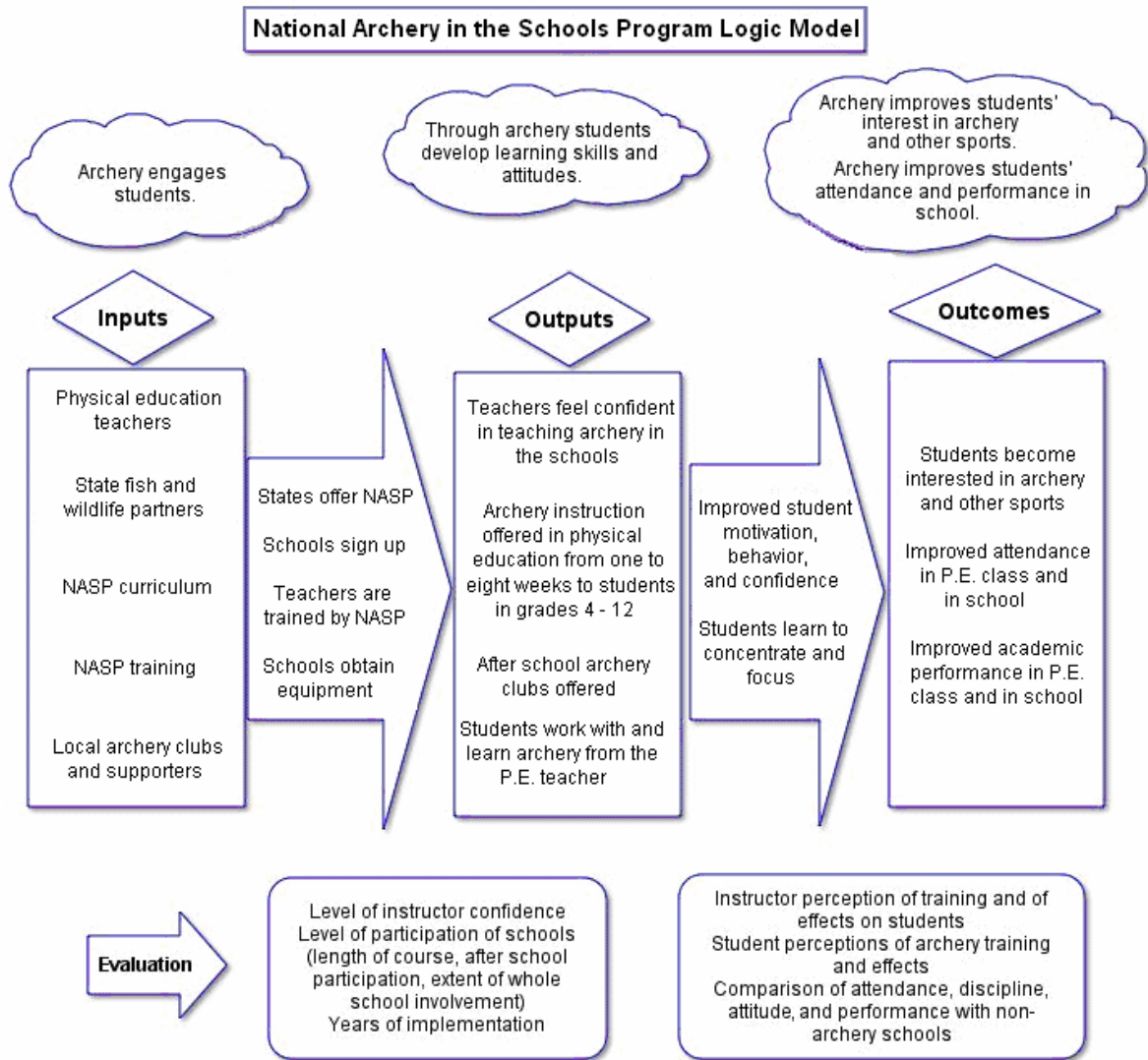
Although the research on physical activity and participation in sports is abundant, in general, studies related to target sports are somewhat limited. In a study of outdoor activities, including archery, Dismore and Bailey (2005) suggest that adventurous outdoor activities impact academics through intellectual and social development. Similar to the current study, that project involved an in-depth study of nine schools and over 600 students to measure the impact of the “I Can!” program on student learning. Another particularly relevant study of students participating in dart throwing suggests that students who engage in self-regulation and strategic goal setting are more apt to attribute failure to inadequate strategies rather than to an intrinsic lack of ability or effort (Kitsantas, 1997). Further, the students in that study appeared to exhibit higher levels of self-efficacy, motor skills, and satisfaction with their performance.

Responsive Management (2005) conducted a study commissioned by the Archery Trade Association to help assess the NASP in Kentucky and the effect the program has on student attitudes toward and participation in archery and bowhunting. Specifically, that study examined student participation in archery and bowhunting prior to implementation of the NASP and after completion of the NASP program to determine if there was an increase in interest and participation in archery and bowhunting. The results of the study were based on self-reported reactions to the program and its effect on student behavior. Responsive Management obtained 1,494 completed questionnaires. The results of that program assessment in Kentucky schools indicate that, in general, students enjoy the course, that the course has a positive impact on student self-esteem and sense of accomplishment, and that the course produces better archery shooting skills and a subsequent increase in interest and participation in archery. The survey showed that students liked the course and considered it to be exciting. In a choice whether the course made P.E. class better or worse (or the same), they chose better over worse by about 11:1. Regarding whether the course made school better or worse, they chose better over worse by about 16:1. The course had a positive effect on students’ self-esteem—a majority said that they felt very good about themselves while taking the course, and a majority said that they felt better about themselves upon finishing the course. The course also gave students a sense of accomplishment, as a majority reported that they got a lot better at shooting a bow and arrow while taking the course. Although that study did not assess effects on specific academic measurements (e.g., GPA, standardized test scores), results suggest that the program had a positive effect on student self-esteem and confidence.

### **The NASP in Context of Sports Activities and Academic Performance**

Building on this review of past research regarding physical activity (including P.E. and sports participation) and academic performance discussed above, researchers hypothesize that the NASP has a positive effect on overall academic performance of students. Specifically, researchers hypothesize that learning archery is engaging to students; that archery participation improves learning skills and attitudes; and that archery positively affects students’ attendance and performance in school. It is also conjectured that the archery program increases students’

and their families' interest in archery and other sports. These hypotheses are contained in the NASP Logic Model (Figure 1) that was developed to show the intended inputs, outputs, and outcomes of the NASP. The outcomes depend, in part, on the hypotheses, which are also shown in the NASP Logic Model. Finally, the NASP Logic Model includes the evaluation parameters to be studied.



**Figure 1. National Archery in the Schools Program Logic Model**

The outcomes of the NASP Logic Model depend, in part, on the four hypotheses shown in the NASP Logic Model and that are written below. This study seeks to assess the validity of these hypotheses. The four hypotheses are:

1. Learning archery is engaging to students.
2. Through archery, students improve learning skills (focus and concentration, ability to work with teacher and others) and attitudes (motivation, behavior, confidence).
3. Archery increases students' interest in archery and other sports, and student participation in the archery program increases family interest in archery.
4. Archery positively affects students' attendance and performance in school.

## II. DESIGN AND METHODS

The evaluation of the NASP and its effects on student attendance and academic achievement, as well as its effects on student and family interest in archery, was completed in three phases:

- Phase I: A survey of NASP instructors regarding their observations and perceptions of the effects of the NASP
- Phase II: A survey of students who participated in the NASP and students who did not participate in the NASP
- Phase III: An analysis of student grades to assess student performance as it related to NASP participation

This report is the final phase of the study, Phase IV, and is based on the three previous Phases.

### Phase I: Instructor Survey

Phase I of the study entailed a survey of NASP instructors. The NASP is in 46 states; state fish and wildlife agencies in 10 of those states volunteered to work with schools to participate in the study. The participating states were Alabama, Arizona, Arkansas, Florida, Georgia, Indiana, Kentucky, Michigan, Minnesota, and Ohio. Responsive Management conducted the instructor survey from August through September 2008 and obtained a total of 408 completed questionnaires.

Phase I of the study examined the four hypotheses of the NASP Logic Model (see Figure 1):

1. Learning archery is engaging to students.
2. Through archery, students improve learning skills (focus and concentration, ability to work with teacher and others) and attitudes (motivation, behavior, confidence).
3. Archery increases students' interest in archery and other sports, and student participation in the archery program increases family interest in archery.
4. Archery positively affects students' attendance and performance in school.

### Design of the Instructor Survey

Responsive Management began with two focus groups of students and instructors in Minnesota and Georgia and a review of past research on self-regulation and motivation and the effects of physical activity on academic achievement, the purpose of which was to inform survey design and development. Content validity of the instructor survey was established through the review of the past research. Construct validity of the survey was established through a review of the surveys by education experts.

The instructor survey included questions designed to assess instructors' perceptions of student engagement with archery, teacher satisfaction with the NASP, conditions of the NASP implementation, characteristics of the teacher and the school, the perceived effects of the NASP on students' learning skills (such as focus and concentration), the perceived effects on students' attitudes (such as motivation and behavior), the effects of the NASP on attendance in P.E. and in school, and the effects of the NASP on student academic achievement.

The questionnaire consisted of open-ended and closed questions. Open-ended questions have no list from which to choose a response and required instructors to answer the question in their own words. Closed questions have a list from which to choose answers. Additionally, some questions stipulated that only one answer be given, and other questions asked that instructors check all answers that applied.

### **Administration of the Instructor Survey**

Responsive Management worked closely with the NASP coordinators in each state to contact NASP instructors individually. Instructors received an initial e-mail explaining the purpose of the project and requesting their participation. If they wished to participate, they were asked to complete the instructor survey. Instructors were later sent an additional e-mail with a link to the online survey. (As an alternative, instructors were given the option to complete a scheduled interview at their convenience with Responsive Management's professional staff, although none chose this method.) To encourage participation, instructors who completed the survey were entered into a drawing to win a free archery bow for their classroom. As stated previously, Responsive Management conducted the survey from August through September 2008 and obtained 408 completed questionnaires. A central data management site at the Responsive Management office allowed for rigorous quality control over the data collection.

Responsive Management used web-based data collection for all the instructor surveys. The surveys were taken online and were entered directly into the web-based database by the instructors as they completed the questionnaires.

### **Analysis of Instructor Survey Data**

All data from the 408 completed instructor questionnaires were analyzed using SPSS for Windows software and proprietary software developed by Responsive Management. Data processing and analysis included coding of the syntax to analyze the data, checking the data for logic and consistency, straight tabulations of data, crosstabulations of data, and chi-square testing. Responsive Management created data tables and graphs to correspond to each question for easy review and visual display of survey data results.

Results of the instructor surveys were analyzed to obtain descriptive statistics as well as to examine relationships among variables. Crosstabulations of survey results were tested for statistical significance using chi-square testing. Descriptive statistics about each of the variables were created using the results of the instructor surveys.

## **Phase II: Student Surveys**

Phase II of the study entailed surveys administered to students enrolled in the NASP (hereinafter referred to as NASP students) and a control group of students who were not exposed to the NASP curriculum (hereinafter referred to as control students). The purpose of Phase II was to examine the four hypotheses identified in the NASP Logic Model (see Figure 1) and to produce a baseline understanding of program outcomes. As with the instructor survey, ten state fish and

wildlife agencies volunteered to work with schools to participate in Phase II of the study. For Phase II, Responsive Management obtained a total of 3,355 completed NASP student questionnaires and 1,145 completed control student questionnaires from September 2008 to May 2009.

### **Design of the Student Surveys**

To examine the hypotheses, surveys were administered to two student groups: students who had taken the NASP and students who had not. The student surveys included questions designed to assess student engagement with archery, student satisfaction with the NASP and the instructors, student interest in and opportunity to experience the NASP, student involvement and participation in the NASP, student characteristics, the NASP's effects on the development of learning skills (such as focus and concentration), the NASP's effects on student attitudes (such as motivation and behavior), student interest and involvement in archery and other sports, family interest and participation in archery, student attendance in P.E. and school, student performance in school, and the effects of the NASP on student interest in other sports. Control students were asked similar questions, where applicable, about their school experiences and their attitudes. On those similar questions, results were compared to results of the survey administered to NASP students.

As with the instructor survey, the survey design and development process for the student surveys included a review of qualitative data from two focus groups of students and instructors conducted by Responsive Management in Minnesota and Georgia. Content validity of the surveys was established through the aforementioned review of the past research, and construct validity of the surveys was established through a review of the surveys by education experts. These questionnaires also consisted of open-ended and closed questions, as well as "check only one" and "check all that apply" questions.

### **Administration of the Student Surveys**

Responsive Management worked closely with the NASP coordinators to contact more than 500 schools to recruit instructors willing to assist with this study. Instructors received an initial e-mail explaining the purpose of the project and requesting that they work with Responsive Management to administer the surveys to their students. For each school, instructors were asked to give an estimate of how many students they could commit to taking the survey (note that the number of committed students was simply an estimate, which was subject to change). In all, 47 instructors worked closely with Responsive Management.

Responsive Management's research associates worked closely with these instructors to accommodate survey implementation within their schools, providing a packet of materials and instructions for implementing the survey both online and by paper and pencil, based on classroom flexibility, access to Internet services, and instructor preference. Throughout the administration of the surveys, Responsive Management carefully tracked and monitored the number of "committed" respondents and sent several reminders, when necessary, to participating instructors as the deadline for survey completion approached to ensure timely return of the surveys. Additional schools were recruited, as needed.

Responsive Management carefully selected control student schools to minimize demographic differences between NASP-participating schools and the control schools. Control students were selected from two types of schools that were recommended by NASP coordinators in each state: NASP-participating schools that had students who were not yet enrolled in the NASP, and schools that had expressed an interest in starting the program but had not yet implemented the curriculum.

Responsive Management conducted the surveys from September 2008 through May 2009. Responsive Management used web-based data collection for all the surveys. Those surveys taken online were entered directly into the web-based database by the students as they completed the questionnaires. For those students not completing the survey online, paper questionnaires were provided to them by the instructors. The completed paper questionnaires were then mailed to Responsive Management's main office where interviewers familiar with administering surveys entered the data into the web-based database. A central data management site at the Responsive Management office allowed for rigorous quality control over the data collection. Responsive Management maintains its own in-house telephone interviewing and data entry facilities, staffed by professionals with experience conducting studies regarding outdoor recreation, including archery.

### **Analysis of Data from the Student Surveys**

As stated, Responsive Management obtained 3,355 completed interviews with NASP students and 1,145 completed interviews with control students in the ten participating states. (Not all the graphs and data tables are based on this number of responses, because some respondents were purposefully skipped out of certain questions or did not answer all questions.) These data were analyzed to draw conclusions about the effects of archery and the NASP under different conditions of implementation.

All data from the student surveys were analyzed using SPSS for Windows software and the aforementioned proprietary software developed by Responsive Management. Data processing and analysis included coding of the syntax to analyze the data, checking the data for logic and consistency, straight tabulations of data, crosstabulations of data, and chi-square testing. Responsive Management created data tables and graphs to correspond to each question for easy review and visual display of survey data results.

Results of the student surveys were analyzed to obtain descriptive statistics as well as to examine relationships among variables, such as number of years of instructor involvement in NASP and perceptions of the effects on student and teacher confidence. When crosstabulations of survey results were run, chi-square significance values ( $p$ ) were used to determine whether differences in crosstabulated variables occurred by chance or because a statistically significant correlation exists. If the  $p$ -value is 0.05 or less, there is a 95% chance that the observed differences in the data on that variable did not occur by chance. Results are shown in tables at three significance levels:  $p \leq 0.001$ ,  $p \leq 0.01$ , and  $p \leq 0.05$ .

To test the hypotheses, descriptive statistics about each of the variables were created using the results of the student surveys. Student response data about the effects of the NASP were crosstabulated by data about the conditions of the implementation, the satisfaction of the

students, and the demographic characteristics of the students to help understand the interplay of engagement/motivation with effects on various measures of student performance.

### **Phase III: Analyses of Student Grades**

One of the hypotheses of the NASP Logic Model, as shown in Figure 1, is that archery positively affects student attendance and performance in school. To examine this hypothesis, researchers examined 716 students' grades recorded prior to and following their participation in the NASP. Three schools were included within the database: an elementary school in Ohio, a middle school in Michigan, and a high school in Alabama (the names of the schools are not included to ensure confidentiality). Teachers submitted grades to Responsive Management for the following subjects: reading, writing, English, math, science, and social studies and/or history. All grades were based on each school's grading scale. To compare grades across schools and grade levels, several changes were made to the data including:

- Third through eighth grade reading and writing scores were averaged into a composite English score to compare it to ninth through eleventh graders' scores in English.
- Third through eighth grade social studies scores were considered comparable to ninth through eleventh grade history scores.
- The middle school submitted letter grades. Statisticians assigned the following values to letter grades based on the averages of commonly used grading scales: A = 96.5, A- = 91.0, B+ = 88.0, B = 84.5, B- = 81.0, C+ = 78.0, C = 74.5, C- = 71.0, D+ = 68.0, D = 64.5, D- = 61.0, E = 57.5. (Note that no students had an A+.)
- The grading scale for writing for the elementary school students ranged from "1" through "4" (note that no student had received a score of "1"). To allow comparisons, these grades for writing were converted as follows: 4 = 96.5, 3 = 84.5, 2 = 74.5.
- Reading grades for students at the elementary school were also converted: a "+" indicated that the student reads above grade level, which statisticians converted to a score of 96.5; an "=" indicated that the student reads on grade level, which statisticians converted to a score of 84.5; and a "-" indicated that the student reads below grade level, which statisticians converted to a score of 74.5.
- Third graders were awarded letter grades that ranged from A to Z for reading, with O, P, Q, and R equal to reading on grade level. Students reading on grade level were assigned the score of 84.5. The remaining third graders (16 students) who were not reading on grade level were not assigned a score because teachers did not provide a grading scale for the remaining grades.
- Note that not all students had grades for the "before" and "after" categories within each subject. If a student's pre-archery grade in any subject was missing, his/her final grade was excluded from the study.

Statisticians entered grades and 120 other variables into an SPSS database for each student. These variables included the numeric grade values, with the changes discussed above, along with categorical values (i.e., numeric grades converted to letter grades) using an "A" through "E" grading scale, and the numeric range associated with the letter grades. These three fields (the numeric grade value, the letter grade, and the numeric range associated with that letter grade) were included for each respondent's grades before and after the archery course. Also,

statisticians created a variable that examined the differences between the grades recorded before and after the archery course. This variable was then categorized into ranges to demonstrate by how much the grade changed, if at all. Finally, students were classified as above average, average, or below average based on the mean of all their grades included within the database.

Several different types of analysis were completed for this project. Overall, statisticians completed approximately 1,000 data runs examining the relationships between grades and four different variables: gender, grade level, student overall academic performance, and ethnicity.

### III. RESULTS AND DISCUSSION

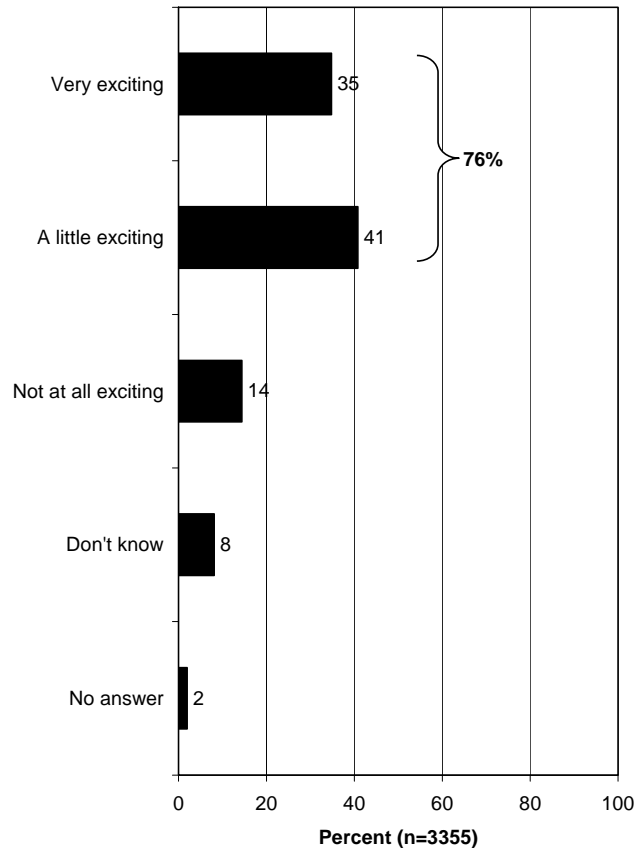
#### Hypothesis 1: Learning Archery Is Engaging To Students

The first hypothesis is that learning archery is engaging to students. It is important to establish the veracity of this statement, because engagement is prerequisite to affecting students' learning skills and attitudes and, subsequently, their attendance and performance.

#### Positive Student Response To Archery

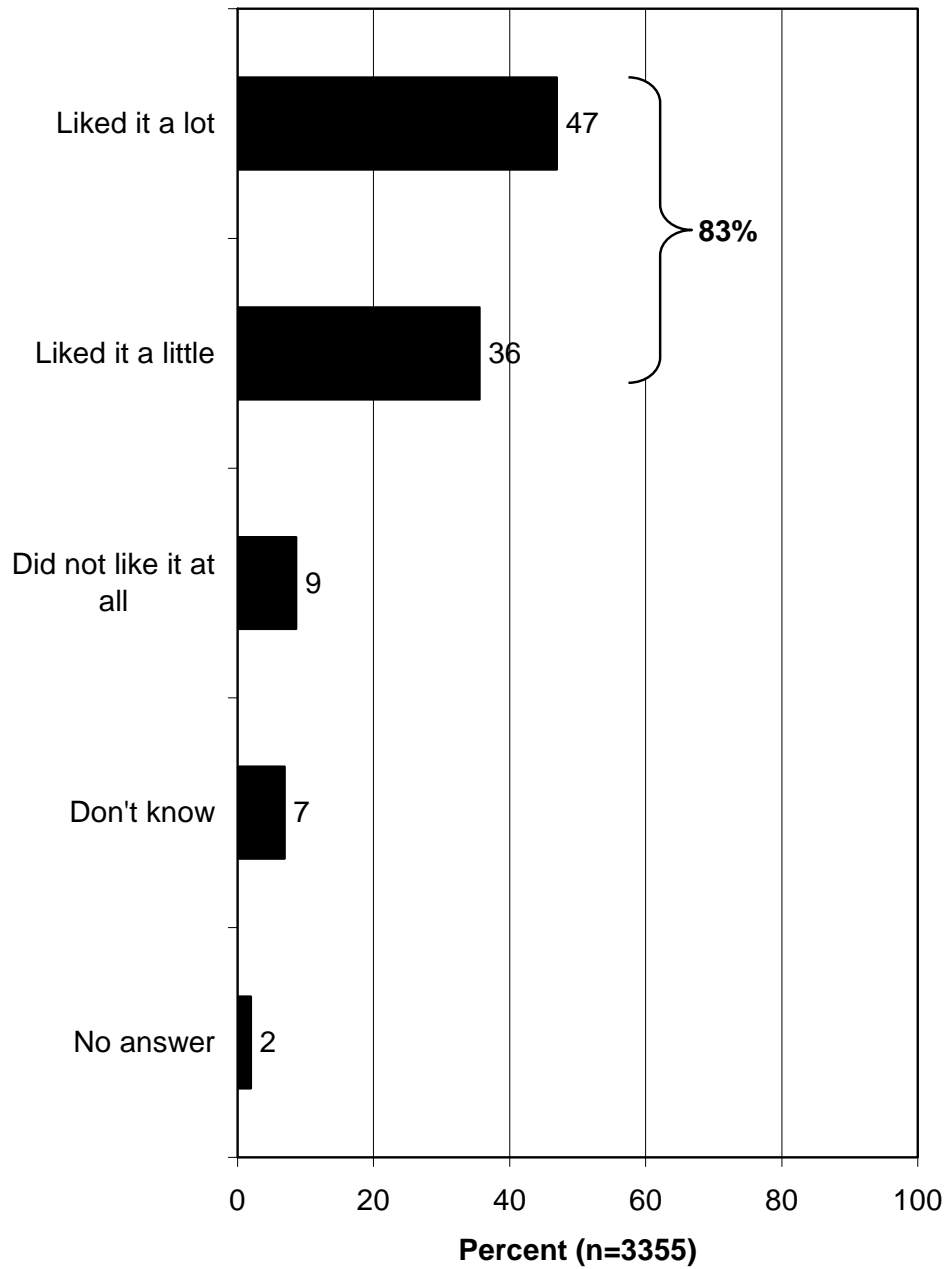
The most direct evidence that the NASP is engaging to students is in the results of the student survey: 76% of NASP students indicated that the archery program was exciting (Figure 2). Only 14% indicated not being excited by the program. Additionally, a large majority (83%) of NASP students liked the archery program in their schools, with 47% reporting that they liked it *a lot* (Figure 3). Only 9% indicated that they did not like it at all.

**Q9. How exciting was the archery program?  
(NASP Students)**



**Figure 2. Excitement of NASP Students with the Archery Program**

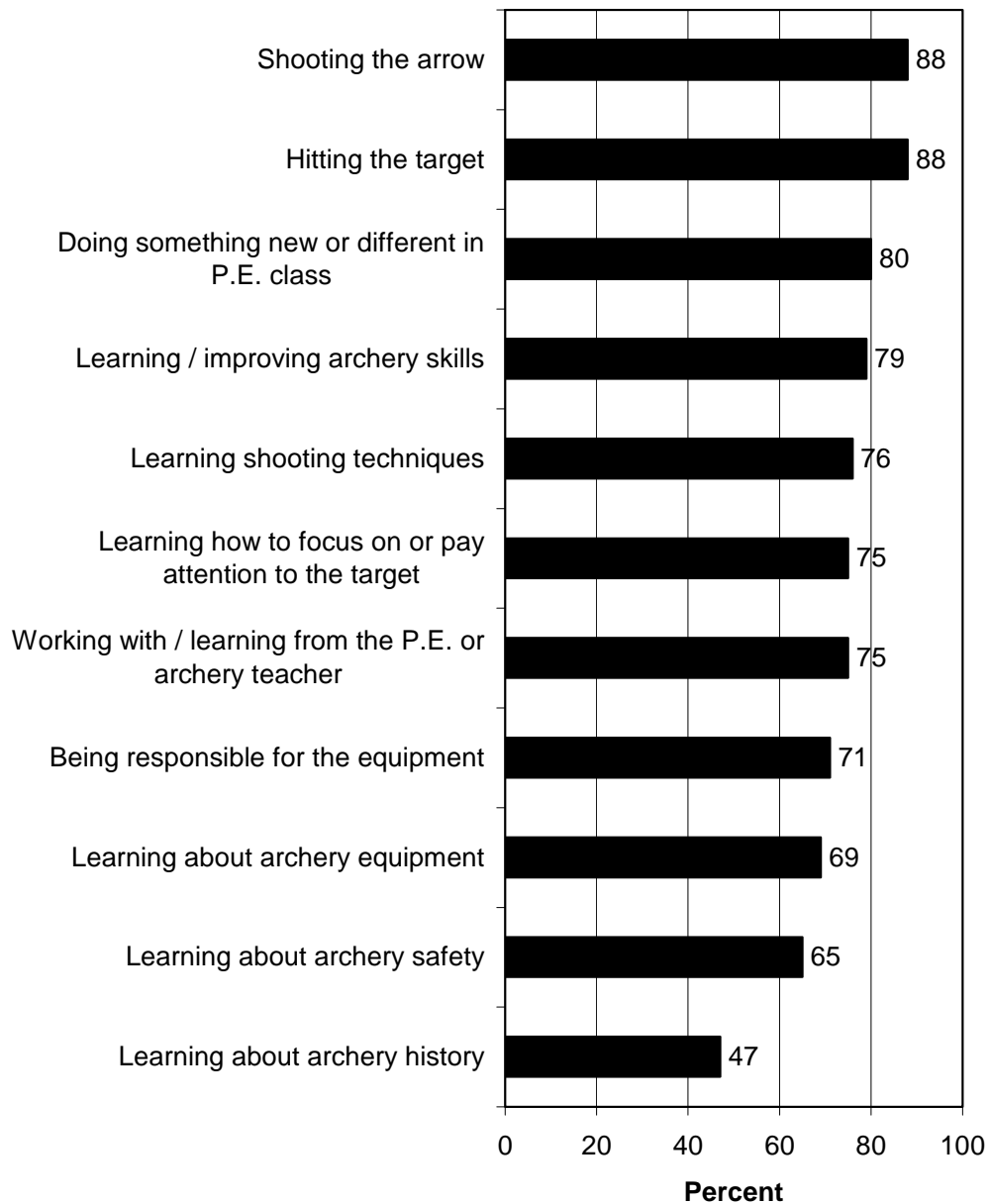
**Q8. Overall, how much did you like the archery program in your school?  
(NASP Students)**



**Figure 3. Overall Satisfaction Rating of the Program by NASP Students**

NASP students were asked to rate how much they liked various *components* of the archery program and curriculum. Nearly all components were liked by large majorities, with all but one component having a majority liking it *a lot* or liking it *okay* (Figure 4). At the top of the list in Figure 4 are shooting the arrow (88%) and hitting the target (88%).

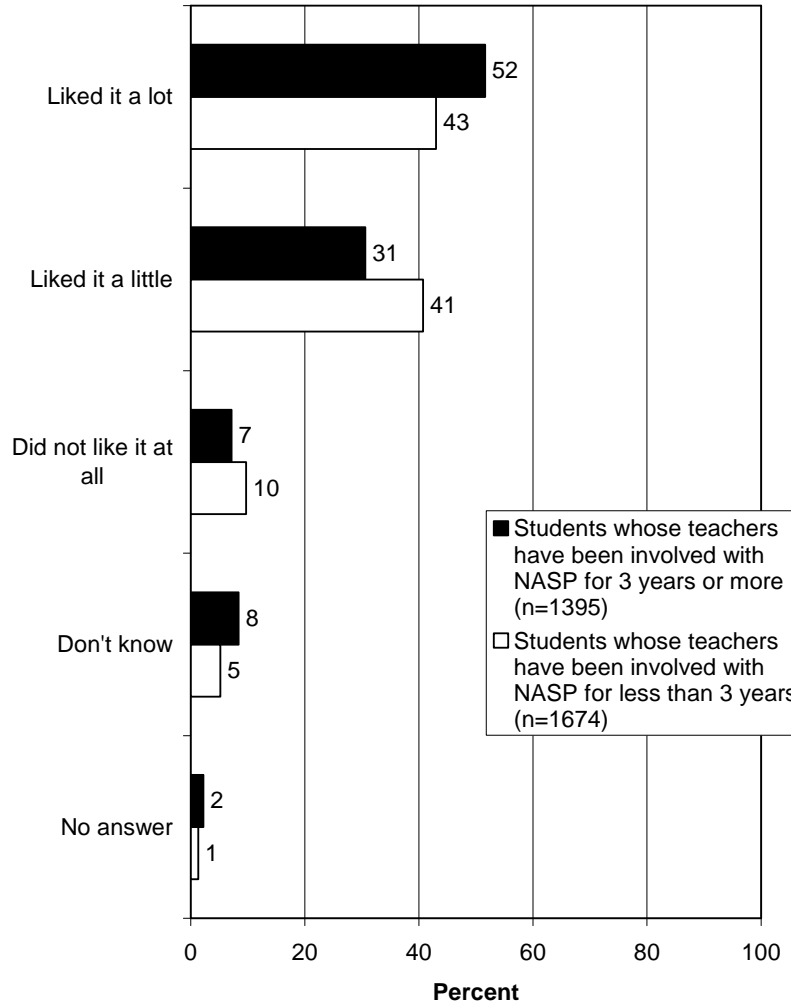
**Percent who rated how much they liked the following parts of the archery program as "I liked it a lot" or "I liked it okay." (NASP Students)**



**Figure 4. NASP Students' Ratings of the Program and Curriculum Components**

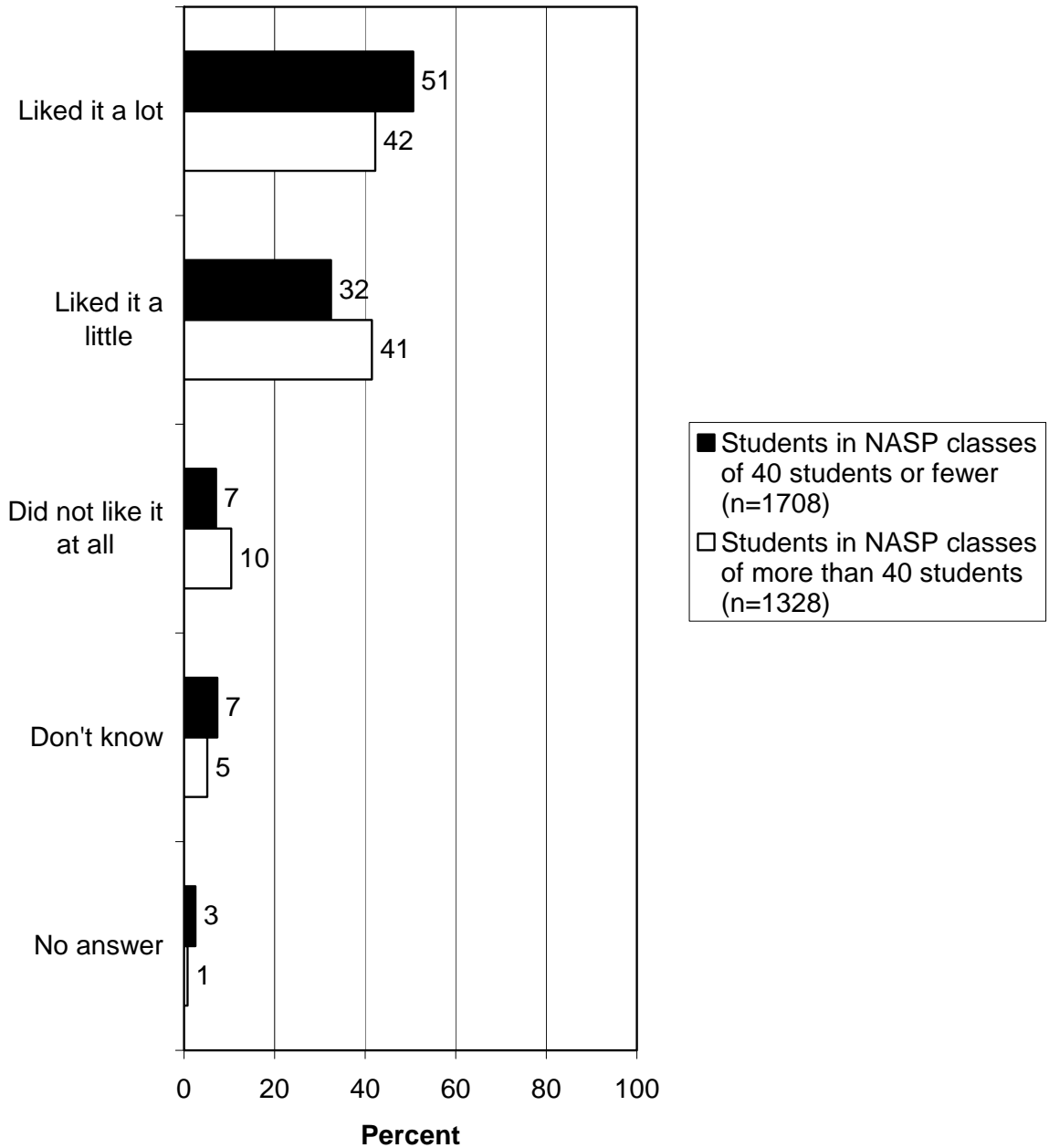
The extent to which students reported liking the archery program was significantly related to their teacher’s experience. Students whose teacher had been teaching NASP for 3 years or more had a higher percentage saying that they liked the program a lot, compared to students whose teacher had less than 3 years of NASP experience (52% to 43%), and this difference is statistically significant ( $p \leq 0.001$ ) (Figure 5). A smaller class size is also correlated to liking the program, with smaller class sizes more often being rated as being liked a lot: 51% of students in NASP courses of 40 students or fewer, compared to 42% of students in NASP courses with more than 40 students, indicated that they liked the program a lot, a statistically significant difference ( $p \leq 0.001$ ) (Figure 6).

**Q8. Overall, how much did you like the archery program in your school?  
(NASP Students)**



**Figure 5. The Degree to Which NASP Students Liked the Program Crosstabulated by Instructor’s Length of NASP Experience**

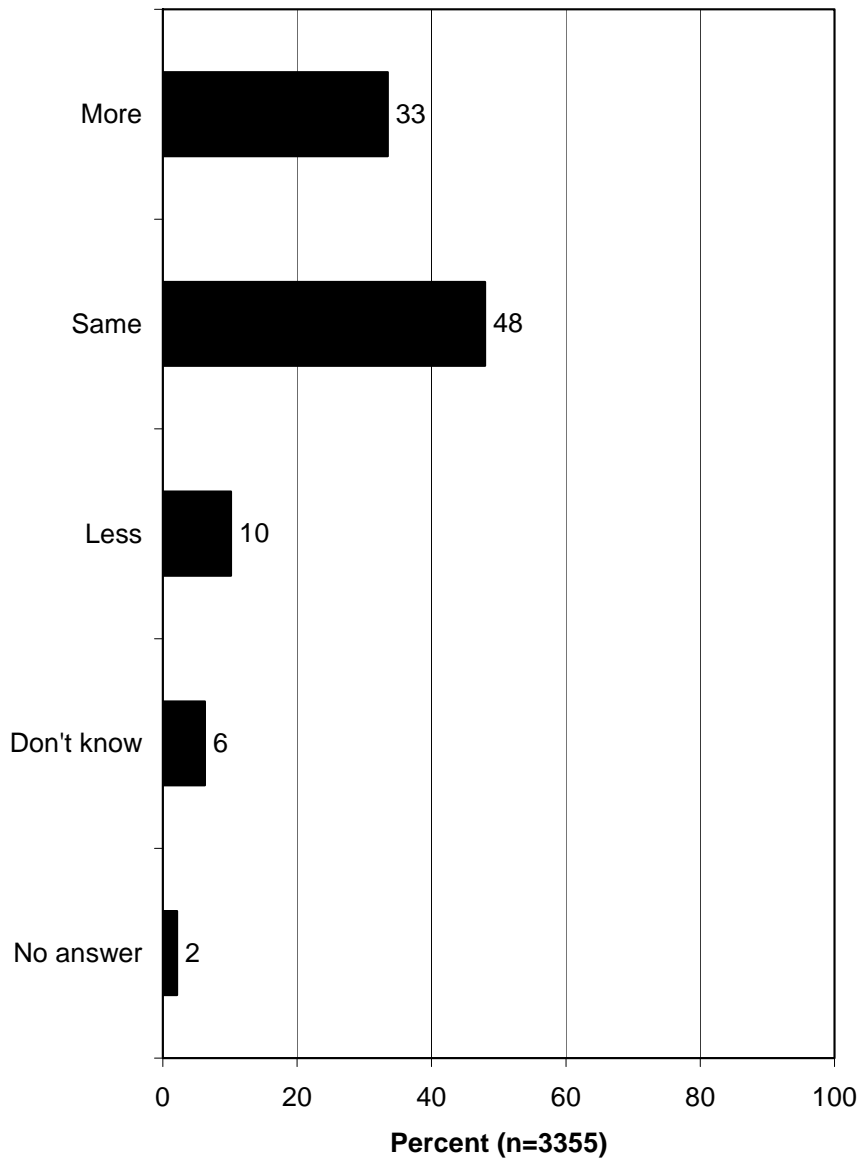
**Q8. Overall, how much did you like the archery program in your school?  
(NASP Students)**



**Figure 6. The Degree to Which NASP Students Liked the Program Crosstabulated by Classroom Size**

Another finding that directly pertains to student engagement is that the percentage of NASP students who looked forward to going to school more (33%) on days that they had archery exceeded the percentage of students who looked forward to going to school less (10%) by more than three times (Figure 7).

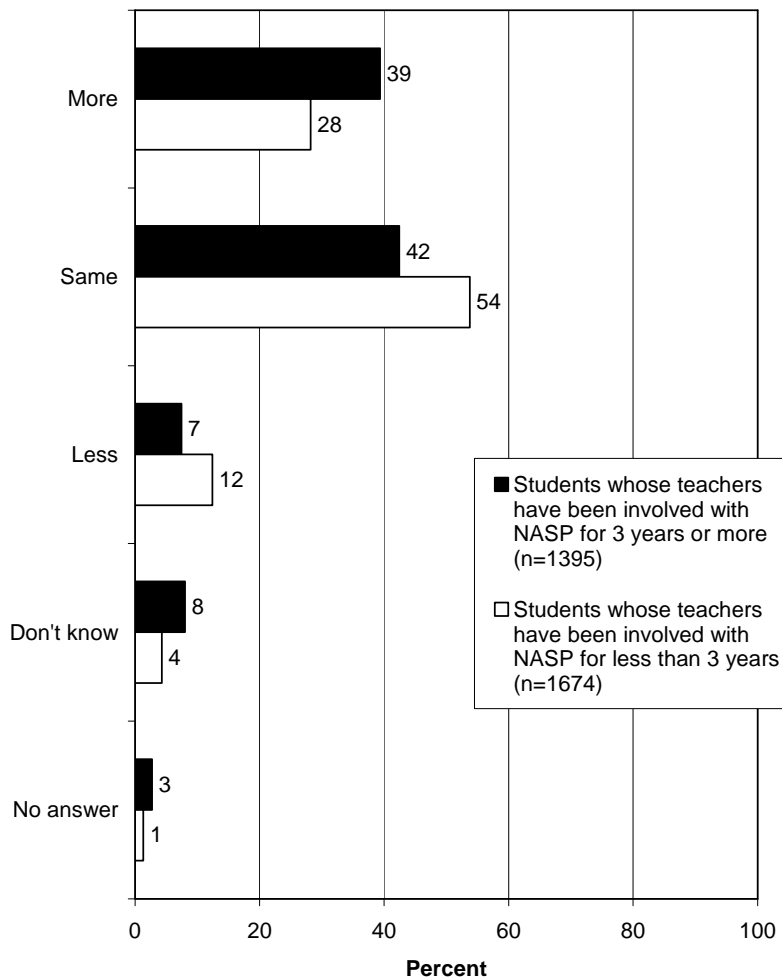
**Q15. Did you look forward to going to school more, about the same, or less on the days you had archery?  
(NASP Students)**



**Figure 7. The Degree To Which NASP Students Looked Forward To School During Days That They Had Archery**

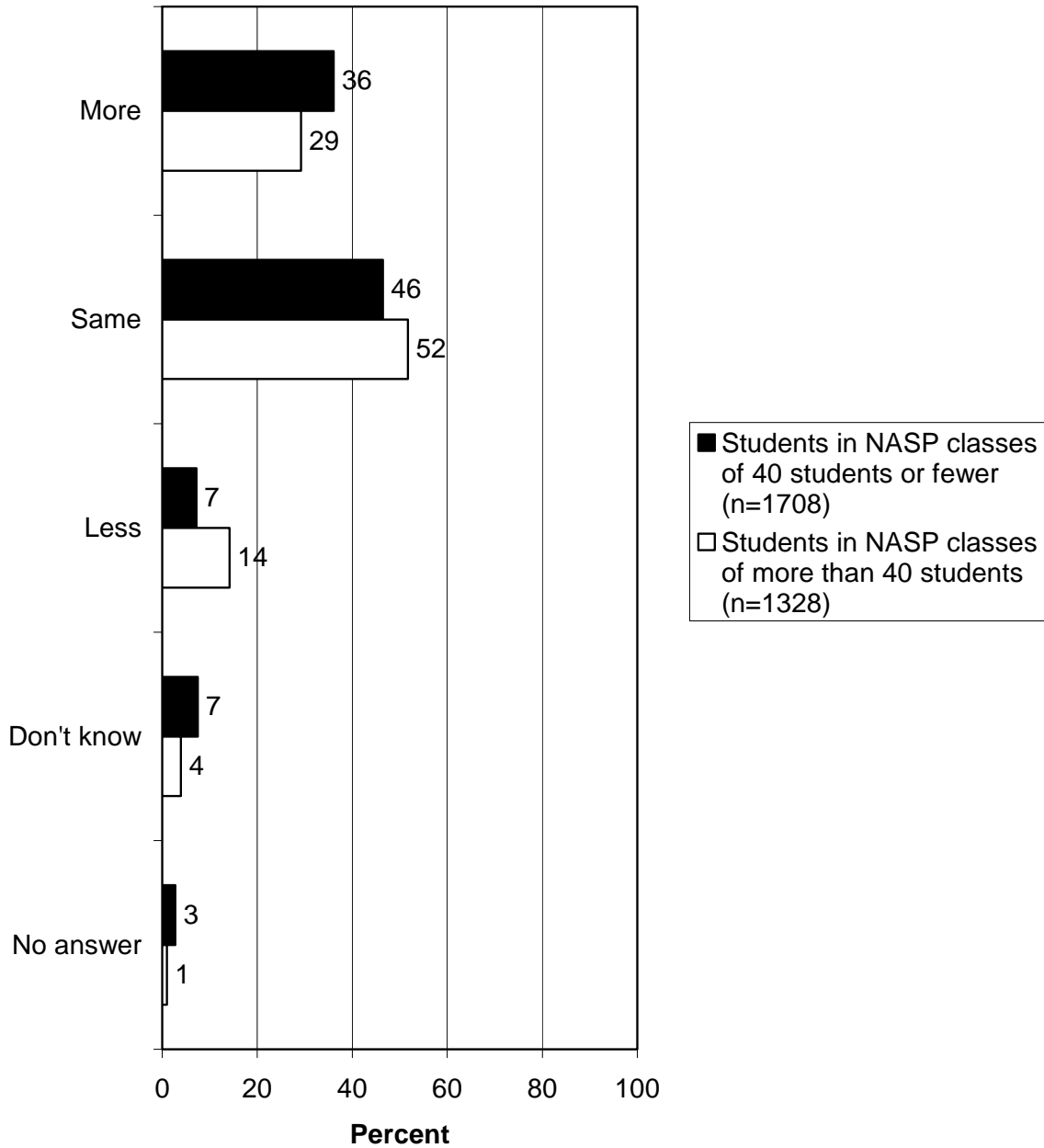
Similar to the results regarding liking the program, the extent to which students reported that they looked forward to school *more* on days that they had archery was significantly related to teacher experience. Students with a teacher who had been involved in the NASP for 3 or more years had a higher percentage (39%), compared to students with a teacher who had been involved in the NASP for less than 3 years (28%), saying that they looked forward to going to school *more* on days that they had archery ( $p \leq 0.001$ ) (Figure 8). Additionally, class size also affected the extent to which students reported that they looked forward to school *more* on days that they had archery. A little over a third of the students whose teacher indicated that there are 40 students or fewer enrolled in NASP at one time (36%) reported that they looked forward to going to school *more* on days that they had archery, compared to less than a third (29%) among students with larger class sizes ( $p \leq 0.001$ ) (Figure 9).

**Q15. Did you look forward to going to school more, about the same, or less on the days you had archery?  
(NASP Students)**



**Figure 8. The Degree To Which NASP Students Looked Forward To Going To School Crosstabulated by Instructor's Experience**

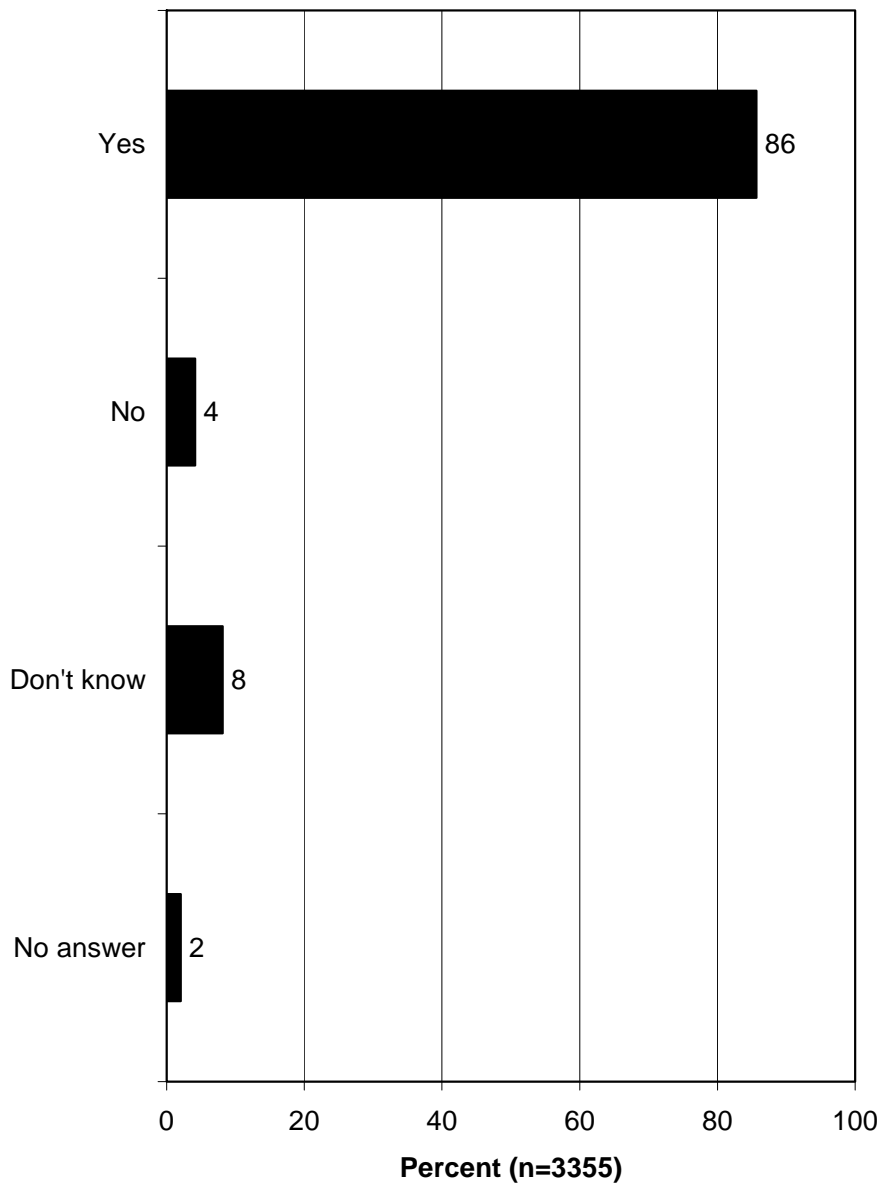
**Q15. Did you look forward to going to school more, about the same, or less on the days you had archery?  
(NASP Students)**



**Figure 9. The Degree To Which NASP Students Looked Forward To Going To School Crosstabulated by Class Size**

The positive results regarding engagement with the archery program is also manifested in students' ratings of their NASP instructors. As shown in Figure 10, an overwhelming majority of NASP students (86%) reported that their instructor did a good job teaching archery, and only 4% answered in the negative (the rest gave neutral answers).

**Q12. Did your archery instructor do a good job teaching archery?  
(NASP Students)**



**Figure 10. Evaluation of Instructors by NASP Students**

## Student Improvement in Archery Skills

Another measure of student engagement with archery is demonstrated by their improvement in skills. As shown in Figure 11, a large majority (78%) of NASP students rated their archery skills as either good (47%) or very good (31%) *after* taking the course, a statistically significant increase over the 47% of NASP students who rated their archery skills as good (34%) or very good (13%) *before* the course. The difference is particularly marked in the “very good” response, which more than doubled from *before* (13%) to *after* (31%).

### Q26a/Q26b. Overall, how would you rate your archery skills before and after taking archery? (NASP Students)

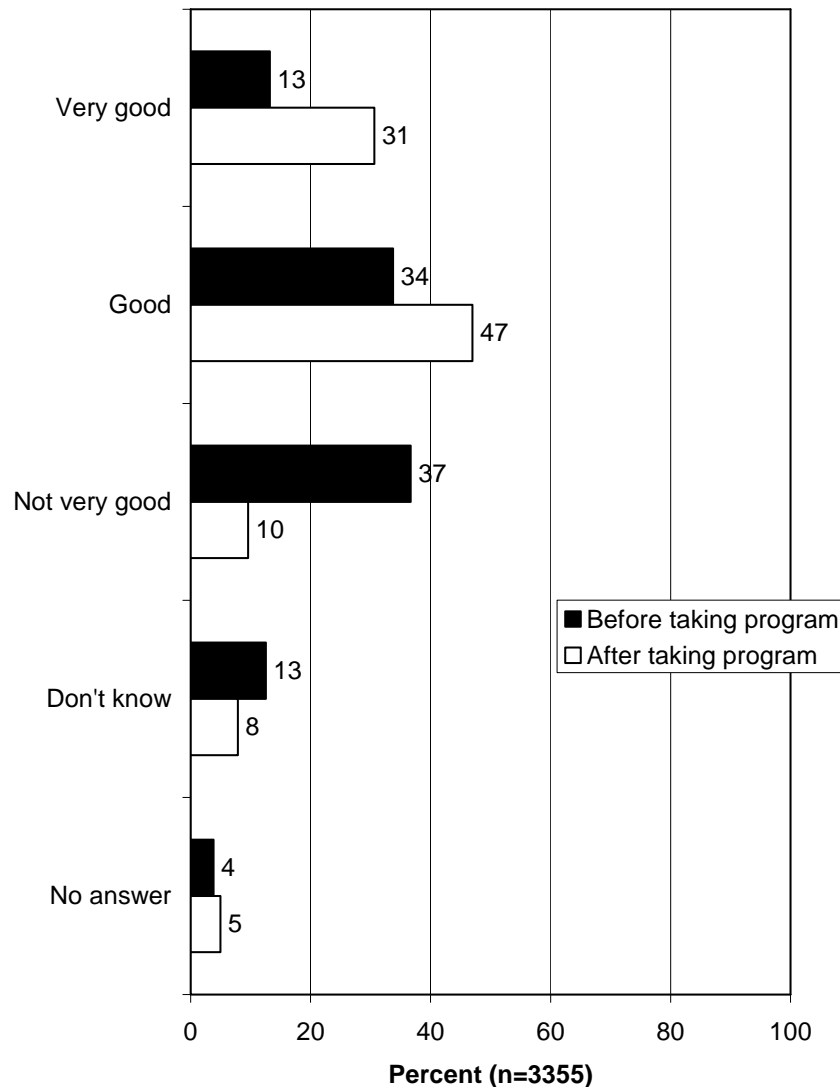
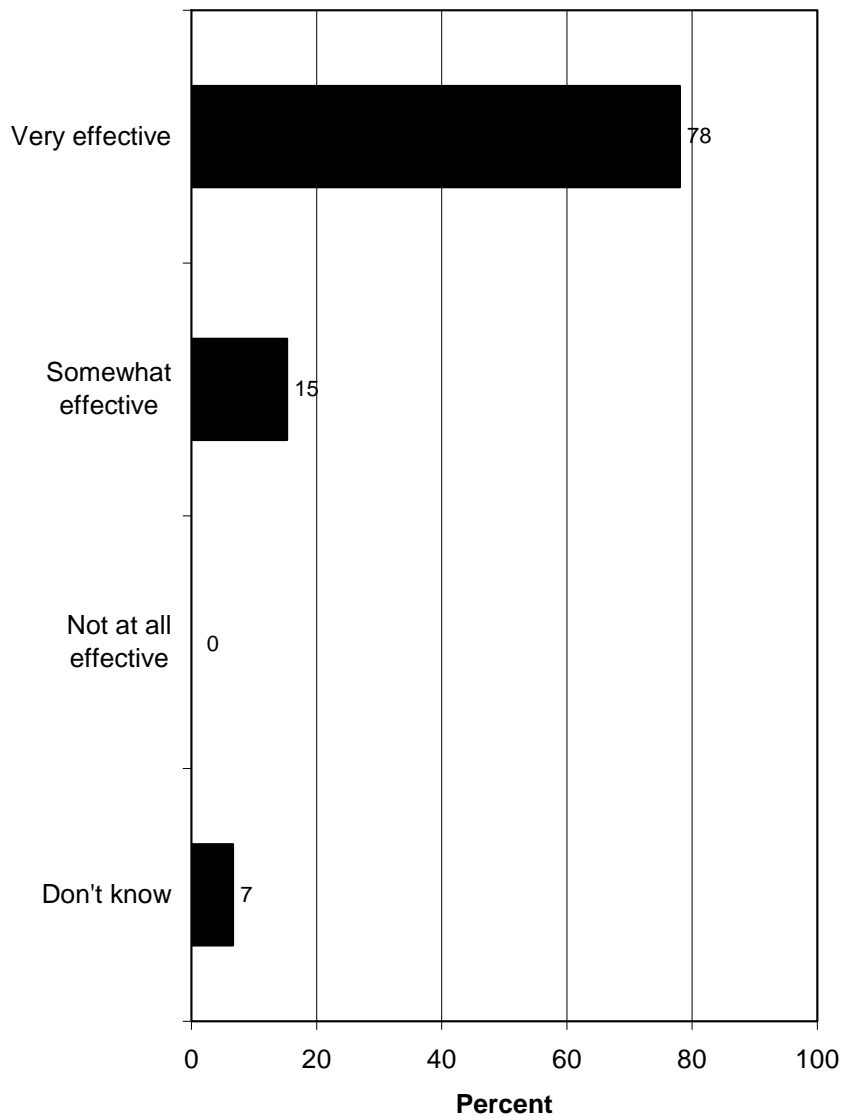


Figure 11. Students' Self-Rating of Their Archery Skills Before and After the Course

## Instructors' Opinions of the NASP

The instructor survey provides evidence that the archery program is engaging to students. In particular, 78% of NASP instructors report that the program is very effective, with another 15% rating the NASP course as somewhat effective—a sum of 93% (Figure 12).

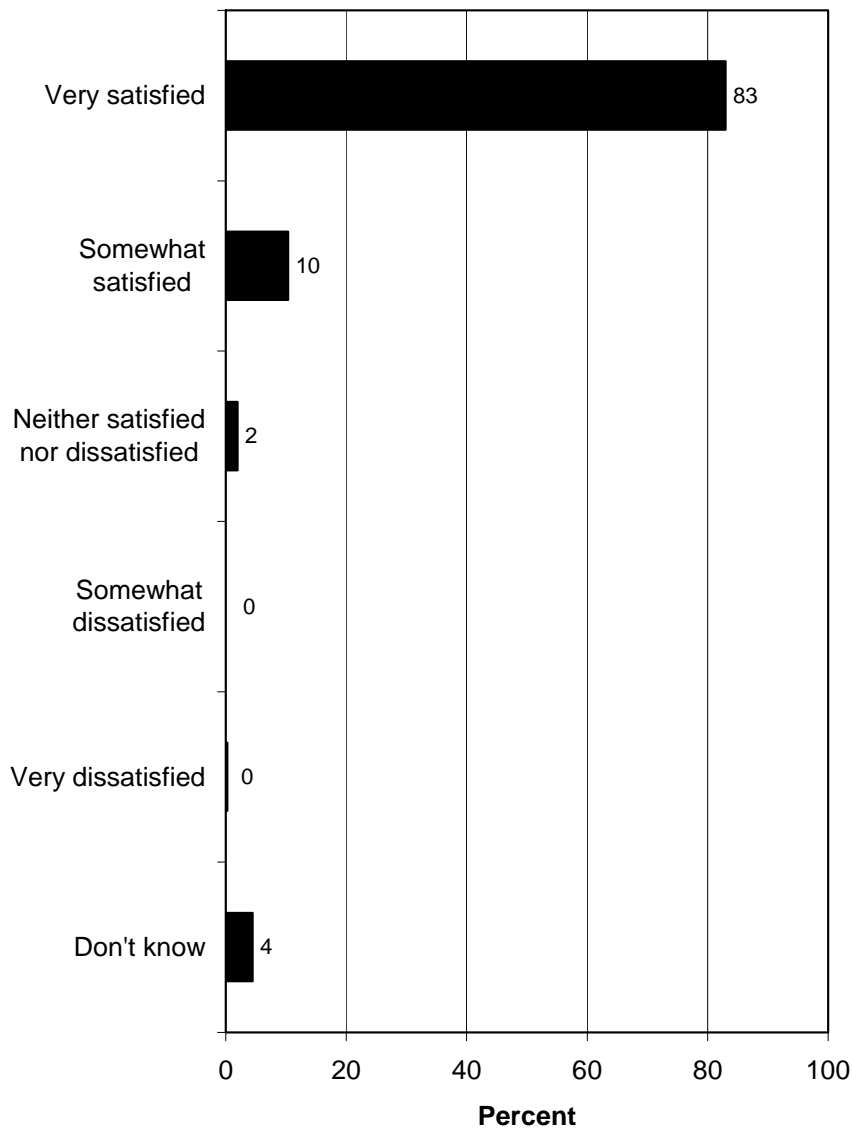
### Q14. How effective is the NASP?



**Figure 12. Instructors' Rating of the Effectiveness of the NASP**

The instructor survey also asked instructors to rate their satisfaction with the program—another indirect measure of student engagement with the archery program. In other words, if the program were *not* engaging to students, instructors would in all likelihood be dissatisfied with the program. Instead, 93% of instructors were satisfied with the NASP, with 83% being *very* satisfied (Figure 13).

**Q13. How would you rate your overall satisfaction with the NASP?**



**Figure 13. Instructors' Satisfaction with the NASP**

## Conclusions About Hypothesis 1: Learning Archery Is Engaging To Students

The findings of the instructor and student surveys suggest that learning archery is engaging to students. In summary, a large majority of NASP students (76%) think that the archery program is exciting. Also, a large majority of NASP students (83%) like the archery program in their schools. When students are asked to rate how much they like various components of the program, for all components except the history of archery, a large majority indicate that they like it. The components at the top of the ranking are shooting the arrow (88% like it a lot or okay), hitting the target (88%), doing something new or different in P.E. class (80%), and learning/improving archery skills (79%).

Additionally, a greater percentage of NASP students say that they look forward to going to school *more* (33%) on days that they have archery than say they look forward to going to school *less* (10%). Furthermore, a large majority (86%) of NASP students say that their instructors do a good job teaching archery.

Students skills improve with the program—a finding that would be unlikely if the students were not engaged by the archery program. Over three-quarters (78%) of NASP students rate their archery skills as either good or very good after taking the course—a marked improvement over their ratings of their skills before the course.

The instructor survey also provides evidence of positive student engagement with the archery program. A large majority of NASP instructors (78%) report that the program is very effective, with another 15% rating the NASP course as somewhat effective—a sum of 93%. Instructor satisfaction with the program is also high: 93% of instructors are satisfied with the NASP, with 83% being *very* satisfied.

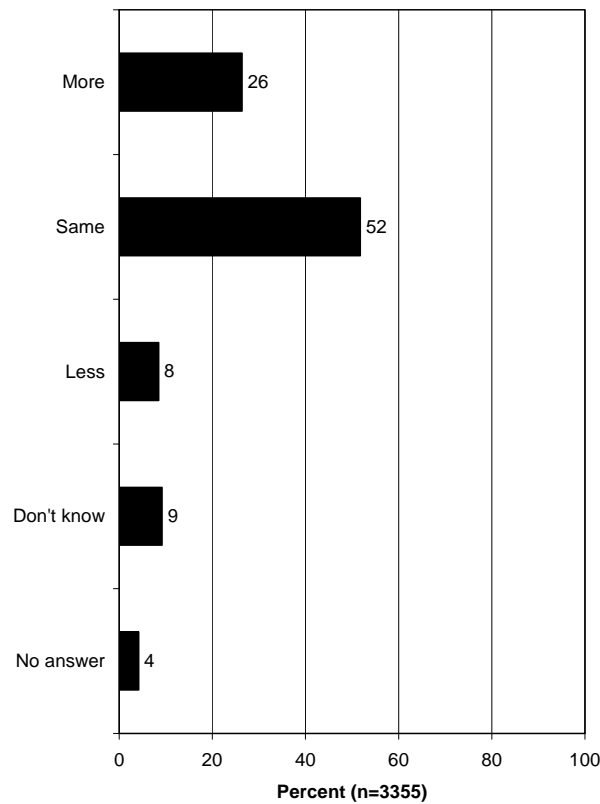
## Hypothesis 2: Through Archery, Students Improve Learning Skills and Attitudes

The results in the previous section strongly suggest that the NASP effectively engages students. How does this engagement affect student learning skills and attitudes? The second hypothesis is that, in the process of learning archery, students learn to focus and to concentrate and they improve with practice, and this experience affects their attitudes and motivations to achieve and helps with their overall learning skills.

### Student Improvement in Concentration and Focus

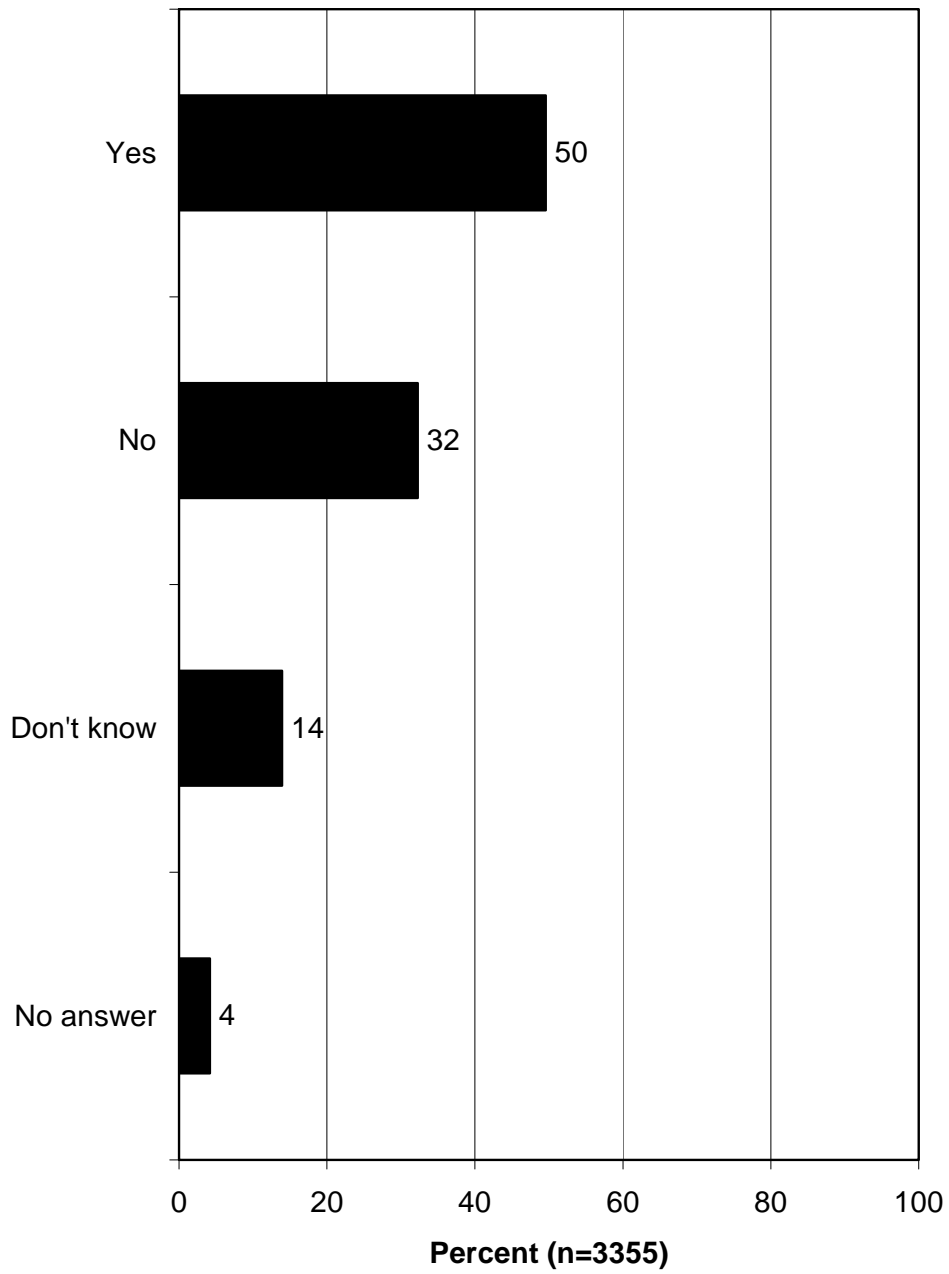
The percentage of NASP students who reported that they paid attention *more* (26%) in archery class compared to other classes exceeded the percentage of students who indicated that they paid attention *less* (8%) in archery than in other classes (Figure 14). Students were also more likely to say that they learned how to pay attention or focus better in archery (50%) than to say that they did not (32%) (Figure 15). Further, among those students who indicated that they learned how to pay attention and focus better in archery, a large majority (64%) indicated that their experience in the NASP helped them pay attention or focus better in learning *other things* (Figure 16).

**Q28. Do you think you pay more, about the same, or less attention to what you are doing in archery than in other classes?  
(NASP Students)**



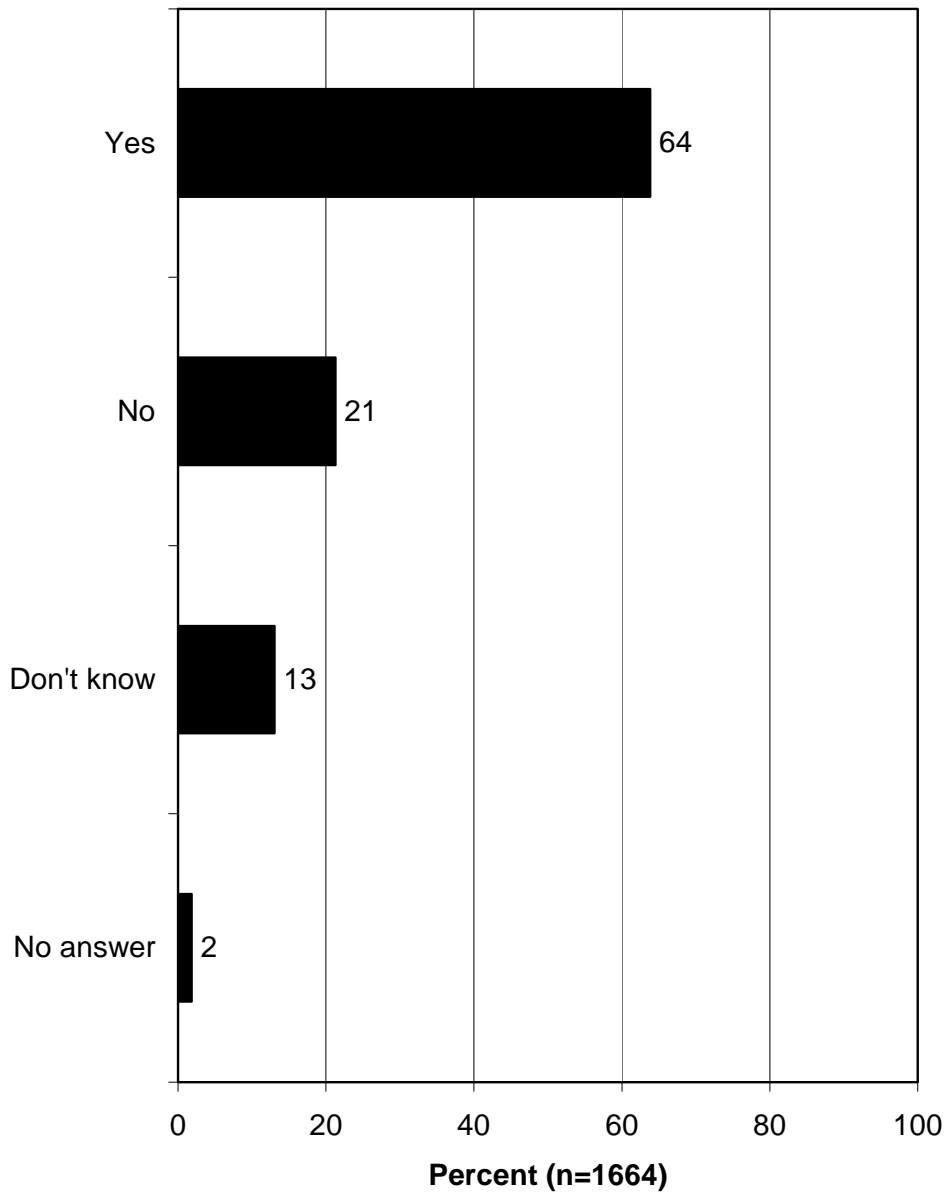
**Figure 14. Attention Paid in Archery Compared To Other Classes**

**Q30. Did you learn how to pay attention or focus better in archery?  
(NASP students)**



**Figure 15. The Effect of the NASP on Students' Attention and Focus**

**Q31. Has the NASP experience helped you to pay attention or focus better in learning other things?  
(Asked of students who indicated that they learned how to pay attention or focus better in archery.)  
(NASP Students)**



**Figure 16. The Effect of the NASP on Students' Attention and Focus in Learning Other Things**

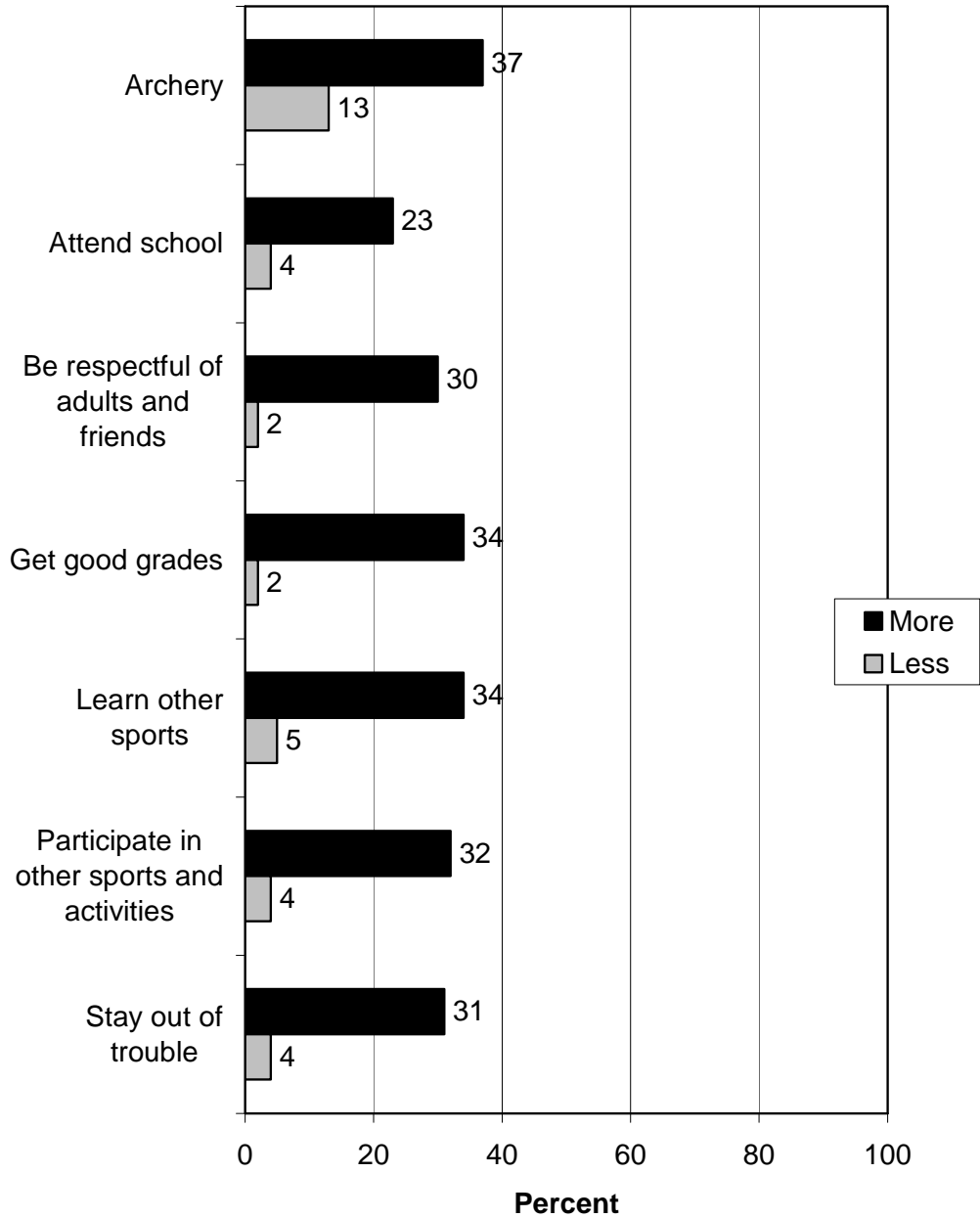
## Student Improvement in Motivation

NASP students were asked about whether the archery program gave them more, the same, or less motivation in several aspects of school and life. For each aspect, the percentage of NASP students who indicated that the NASP gave them more motivation far exceeded the percentage of students who indicated that the NASP gave them less motivation (Figure 17 and Table 1). For all aspects, approximately a quarter or more of NASP students indicated that the NASP had a positive effect on their motivation.

**Table 1. The Effect of the NASP on Student Motivation**

<b>Motivation to:</b>	<b>More</b>	<b>Same</b>	<b>Less</b>
Participate in archery	37%	38%	13%
Attend school	23%	63%	4%
Be respectful of adults and friends	30%	59%	2%
Get good grades	34%	55%	2%
Learn other sports	34%	50%	5%
Participate in other sports and activities	32%	53%	4%
Stay out of trouble	31%	55%	4%

**Q33. Percent who want to do the following things more/less after taking archery:  
(NASP Students)**



**Figure 17. The Effect of the NASP on Students' Motivation and Attitudes**

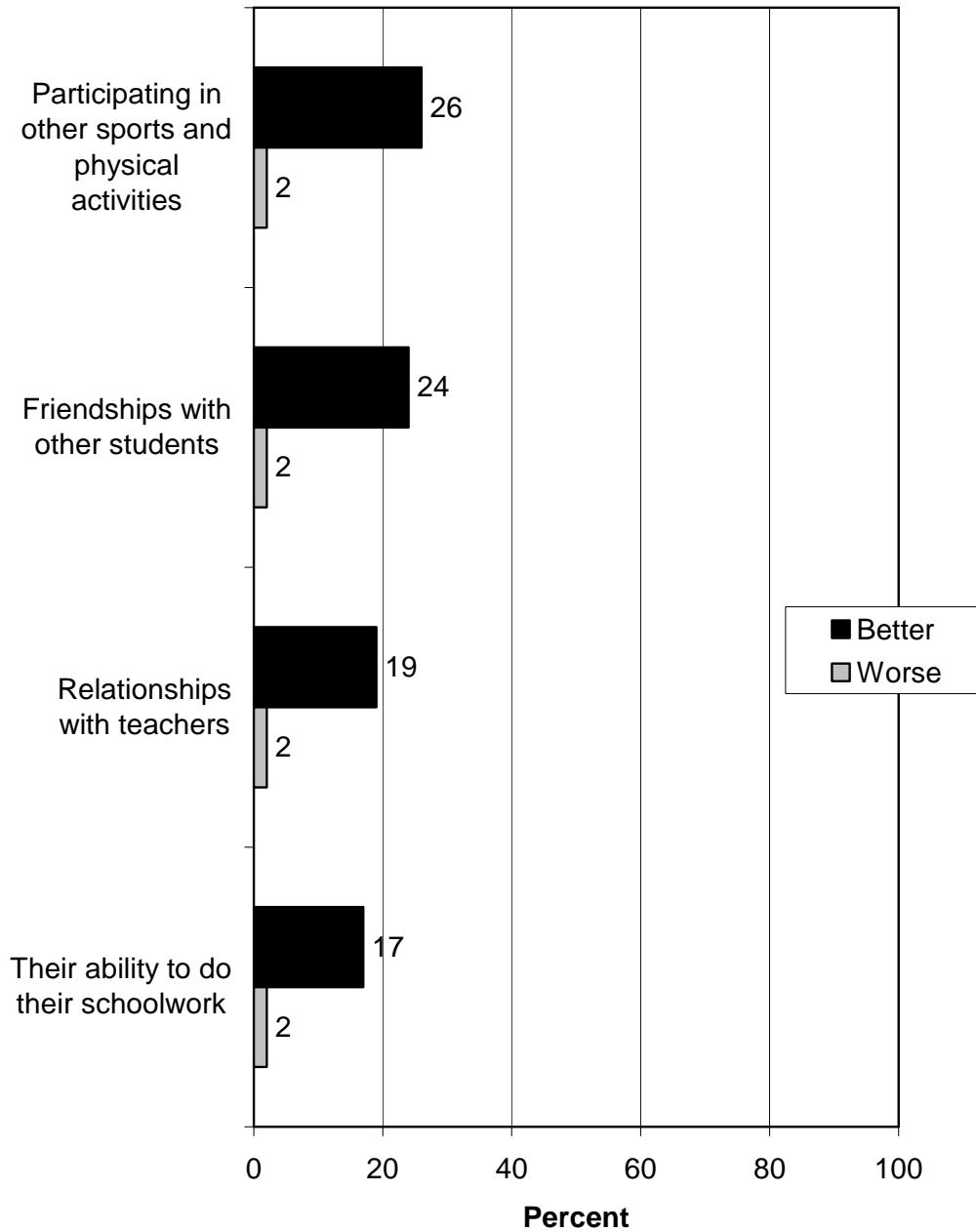
## Student Improvement in Self-Confidence

The survey also asked students if the NASP affected their confidence in several different areas. Again, the percentage of NASP students who indicated that the NASP made them feel better about each area far exceeded the percentage of students who indicated that the NASP made them feel worse (Figure 18). More than a quarter (26%) of NASP students reported that they felt better about participating in other sports and physical activities after taking archery in school. Many students also said that they felt better about friendships with other students (24%), about their relationships with teachers (19%), and about their ability to do their schoolwork (17%) (Table 2).

**Table 2. The Effect of the NASP on Self-Confidence in Relationships with Teachers, in Other Sports, in Friendships, and in Schoolwork**

<b>Self-confidence about:</b>	<b>Better</b>	<b>Same</b>	<b>Worse</b>
Other sports and physical activities	26%	56%	2%
Friendships with other students	24%	60%	2%
Relationships with teachers	19%	61%	2%
Schoolwork	17%	66%	2%

**Q32. Percent who feel better/worse about the following after taking archery:  
(NASP Students)**

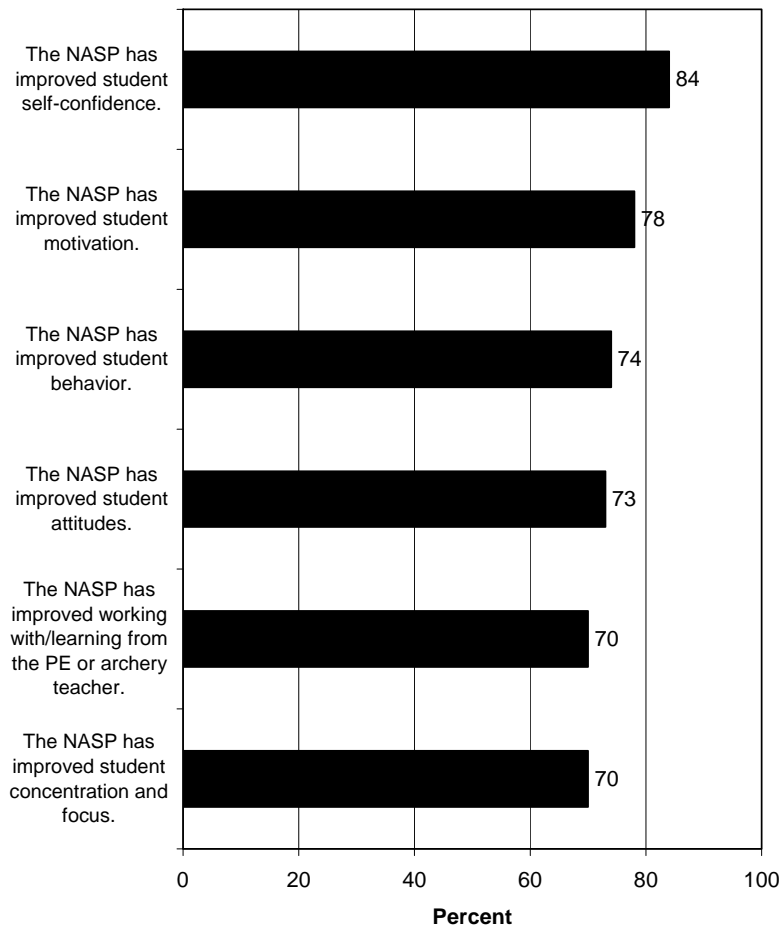


**Figure 18. The Effect of the NASP on Students' Self-Confidence**

## Instructors' Perceptions of Improvements in Students' Concentration, Focus, Motivation, and Self-Confidence

Not only do students indicate that their concentration, focus, motivation, and self-confidence improve after the archery program, instructors perceive that their NASP students' concentration, focus, motivation, and self-confidence improve after the archery program. Figure 19 shows that a large majority of instructors agree with each statement about the positive effect of the NASP on their students. Specifically, most instructors agree that the NASP improved their students' self-confidence (84%), motivation (78%), behavior (74%), attitudes (73%), and concentration and focus (70%).

**Q15. Percent of instructors who moderately or strongly agree with the following statements, based on their experiences teaching the program.**



**Figure 19. Instructors' Perceptions of the Effects of the NASP on Students' Concentration, Focus, Motivation, and Self-Confidence**

## **Conclusions About Hypothesis 2: Through Archery, Students Improve Learning Skills and Attitudes**

The data pertaining to Hypothesis 2 suggest that the NASP positively affects students' learning skills and attitudes. More than a quarter (26%) of NASP students think that they pay *more* attention in archery class than they do in other classes, a percentage that is more than triple the percentage of students who indicate that they pay *less* attention in archery (8%). Students are also more likely to say that they learn how to pay attention better in archery (50%) than to say that they do not (32%). Further, among those students who indicate that they learn how to pay attention and focus better in archery, a large majority (64%) indicate that their experience in the NASP helps them pay attention or focus better in learning *other things*.

When NASP students are asked about whether the archery program gives them more, the same, or less motivation in several aspects of school and life, NASP students more often say that the NASP gives them more motivation than say it gives them less motivation. For most aspects, about a third of NASP students indicate that the NASP has a positive effect on their motivation; typically, less than 5% give a negative answer. Substantial percentages of NASP students say the program gives them more motivation to participate in archery (37%), to learn other sports (34%), to get good grades (34%), to participate in other sports and activities (32%), to stay out of trouble (31%), to be respectful of adults and friends (30%), and to attend school (23%).

The survey also asked students if the NASP affects their confidence in several different areas. Again, the percentage of NASP students who indicate that the NASP gives them more self-confidence in each area far exceeds the percentage of students who indicate that the NASP gives them less self-confidence. More a quarter (26%) of NASP students report that they feel better about participating in other sports and physical activities after taking archery in school. Many students also say that they feel better about friendships with other students (24%), about their relationships with teachers (19%), and about their ability to do their schoolwork (17%).

Finally, instructors perceive that the NASP positively affects students' focus, concentration, motivation, and self-confidence. In a series of agree-disagree statements in the instructor survey, most instructors agree that the NASP improves their students' self-confidence (84%), motivation (78%), behavior (74%), attitudes (73%), and concentration and focus (70%).

### **Hypothesis 3: Archery Increases Students' Interest in Archery and Other Sports, and Student Participation in the Archery Program Increases Family Interest in Archery**

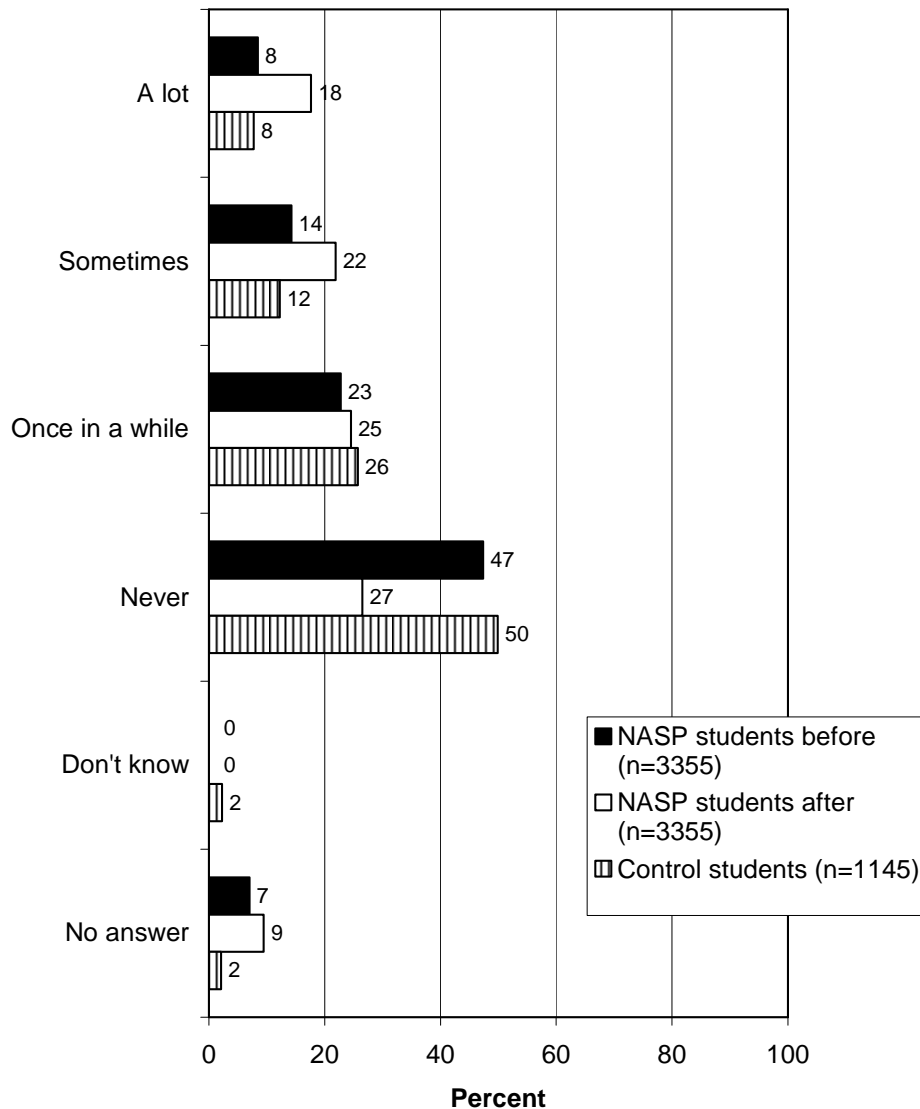
For the analysis of this hypothesis, students reported on the effect that the program has on their interest and involvement in archery and other sports, as well as their family's involvement. This hypothesis is important because studies indicate that student involvement and participation in sports and extracurricular activities may have a beneficial effect on academic achievement. In other words, because there is a correlation between physical activities and student learning skills and behaviors, increasing student interest in various sports may encourage students to participate more fully in their academic experience, thereby affecting their overall performance.

As indicated, this analysis also explored the program's effect on family interest and participation in archery. Within the context of this hypothesis, the NASP has a dual mission: promoting student interest and participation in the sport of archery, and promoting family interest and participation in archery. Numerous studies indicate that early initiation into the shooting sports is vital to recruitment and retention. Further, initiation into these sports almost always occurs within the context of the family. Because most sport shooters start in childhood and because younger initiation is correlated with greater avidity and retention, establishing a culture that embraces archery and the shooting sports is crucial to increased participation; in short, family participation and mentoring play a key role in children's and youth's interest in the shooting sports (Responsive Management/National Shooting Sports Foundation, 2008).

## Increase in Student Involvement in Archery

A graph shows the percentage of NASP students who participated in archery at various levels of frequency before taking archery, the percentage of them who now participate, and the percentage of control students who participate, clearly showing the increase in participation among those who have had archery classes (Figure 20).

**Q2a/Q2b. How often did/do you participate in archery before/after you took archery in school? / Q12a. How often do you do archery?**

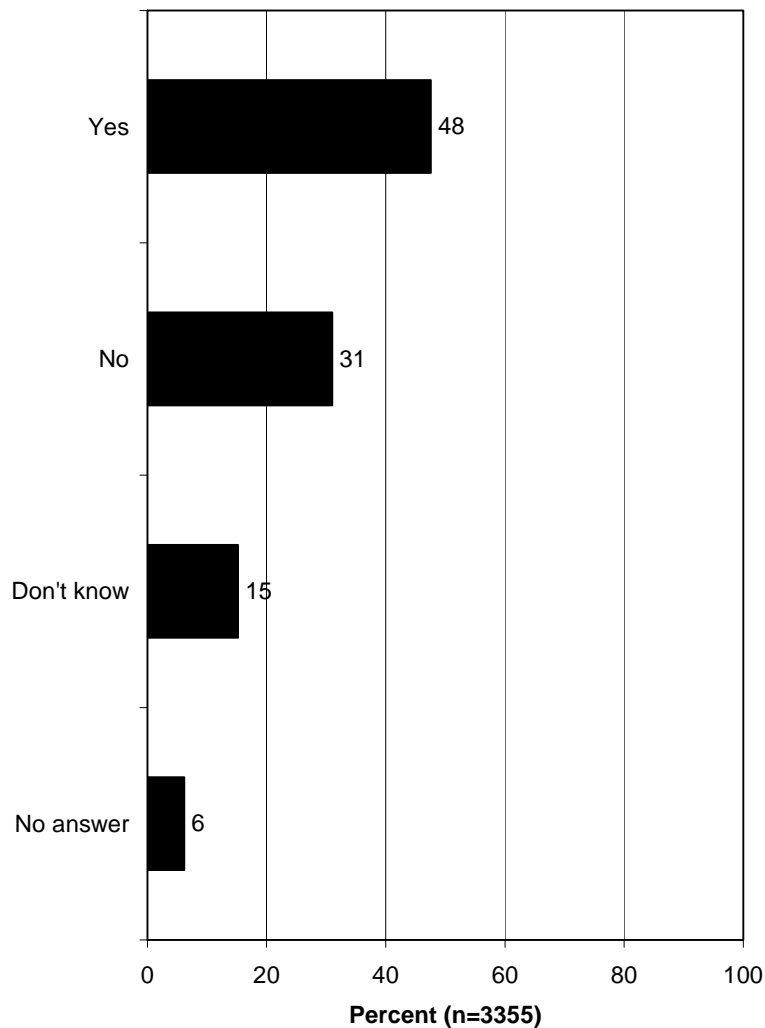


**Figure 20. The Effect of the NASP on Student Participation in Archery**

## Increase in Student Interest in Archery, Hunting, and Other Shooting Sports

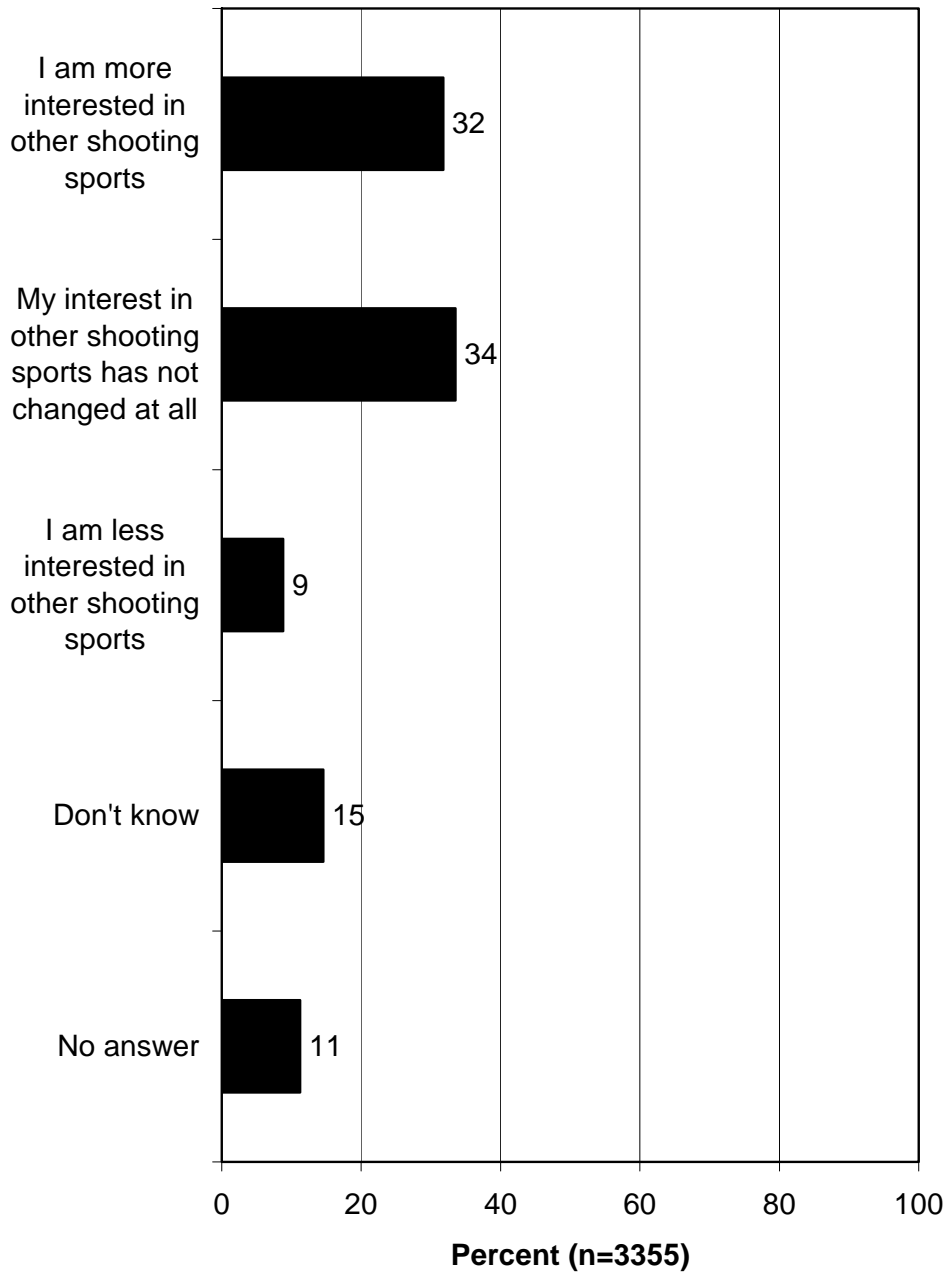
Another finding points out the positive effect of the NASP on student interest in archery. Figure 21 shows that 48% of NASP students reported that they think that they will participate in archery in the future, compared to 31% who do *not* think that they will participate. The NASP appears to have an impact on student interest in other shooting sports, as well. A substantial percentage of NASP students (32%) express more interest in other shooting sports after taking archery (Figure 22).

### Q35. Do you think you will participate in archery in the future? (NASP Students)



**Figure 21. The Effect of the NASP on Interest in Future Archery Participation**

**Q37. How has archery affected your interest in other shooting sports (hunting or target shooting, for example)?  
(NASP Students)**



**Figure 22. The Effect of the NASP on Student Interest in Other Shooting Sports**

### Increase in Family Participation in Archery

When asked specifically about how their participation in the archery program affected their family's interest in archery, a small, but not insubstantial, percentage (11%) of NASP students indicated that their family is more interested in archery (Figure 23).

#### Q42. How has your participation in the archery program affected your family's interest in archery? (NASP Students)

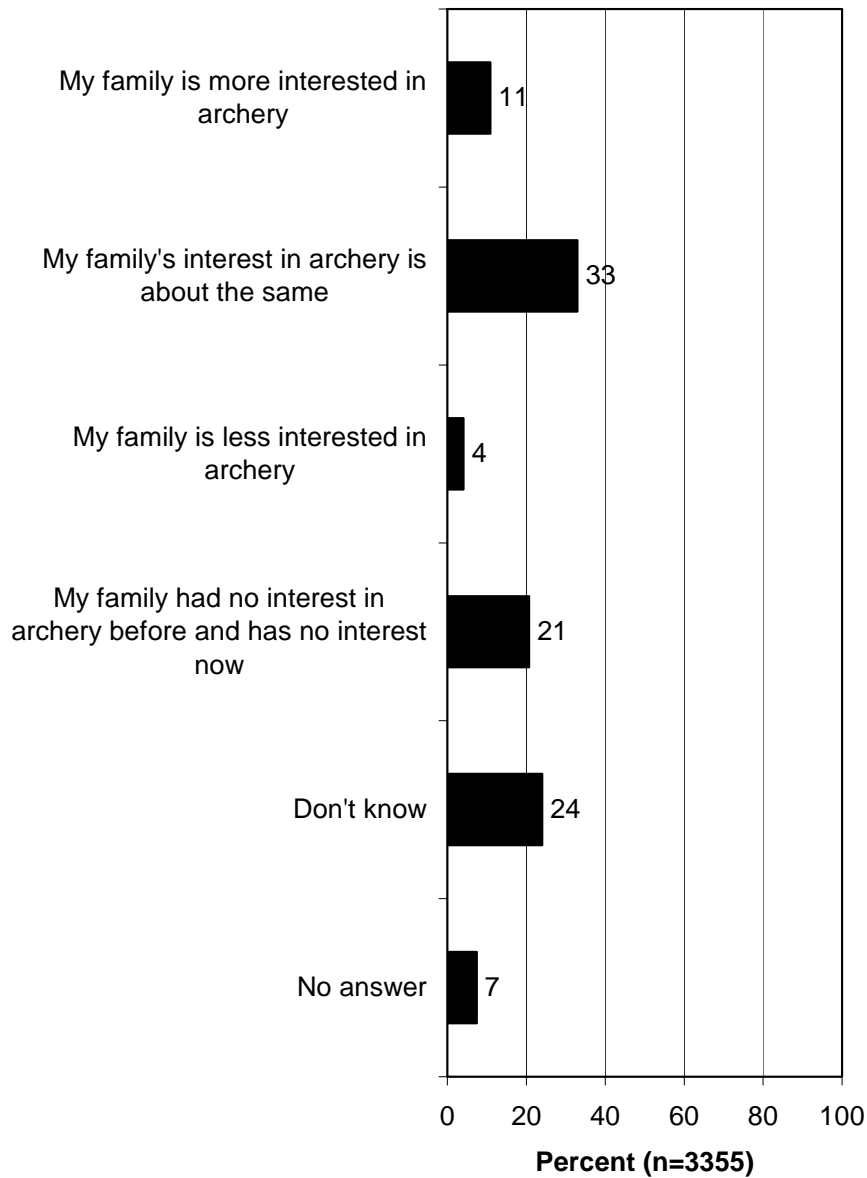


Figure 23. The Effect of Student Participation in Archery on Family Interest in Archery

### **Conclusions About Hypothesis 3: Archery Increases Student Interest in Archery and Other Sports, and Student Participation in the Archery Program Increases Family Interest in Archery**

The data suggest that the NASP increases student interest in archery and other shooting sports. The data further suggest that there is some (although not a great) increase in family interest, as well. A majority of NASP students (65%) indicate participating in archery since taking it in school, and NASP students participate in archery at a greater rate than do control students. Furthermore, nearly half of NASP students (48%) report that they plan to participate in archery in the future, compared to 31% who do not plan to participate in archery. The data suggest that the NASP has a positive effect on student interest in hunting and other shooting sports, with 32% of NASP students expressing more interest in hunting and other shooting sports after taking the archery program in school.

Regarding family participation, the effect appears to be small, but perhaps not insubstantial. Specifically, 11% of NASP students indicate that the NASP increases their family's interest in archery.

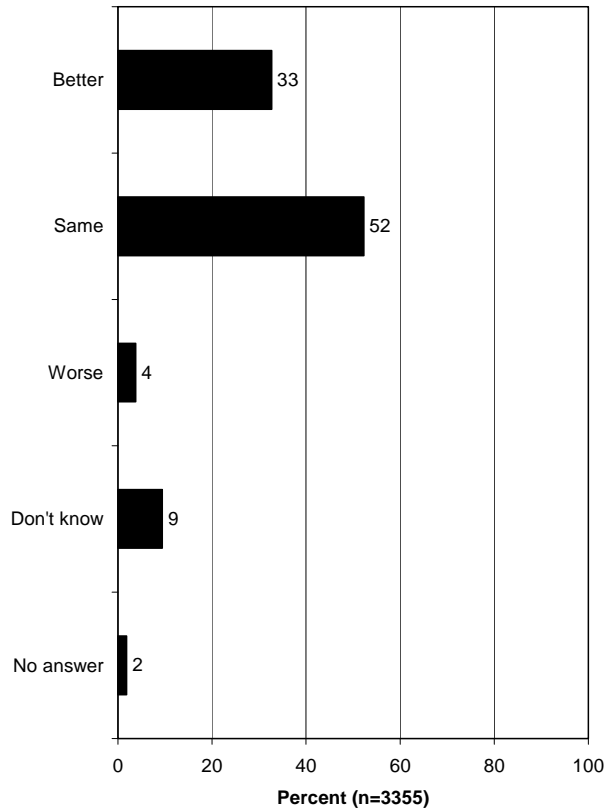
### Hypothesis 4: Archery Positively Affects Student Attendance and Performance in School

The fourth hypothesis follows from the previous three hypotheses and would seem to be intuitive—better attitudes toward school and greater participation in physical activities would, it seems, improve overall attendance and performance in school. Several aspects of the analyses apply to this hypothesis: instructors’ perceptions of student performance, students’ perceptions of their own performance, and actual grades of students.

#### Improvement in Attitudes Toward School

Any effort to improve student attendance at school would undoubtedly be furthered by helping students develop positive attitudes about school, which the NASP apparently does. NASP students were about eight times more likely to say that archery makes school better (33%) than to say that archery makes school worse (4%) (Figure 24). This finding is consistent with the previously reported finding that 33% of NASP students look forward to going to school *more* on days they have archery (see Figure 7).

**Q14. Did the archery program make school better, about the same, or worse?  
(NASP Students)**



**Figure 24. The Effect of the NASP on Attitudes About School**

## Instructors' Perceptions of Improvements in Attendance and Academic Performance

The instructors' survey also obtained some evidence that the NASP has a beneficial effect on attendance and academic performance. About a third of instructors (31%) reported that attendance in P.E. class had increased because of the NASP, while 0% indicated it had decreased (Figure 25). Instructors' responses to two questions regarding academic performance suggest that there is some academic benefit from the NASP: 43% of instructors said that their students' performance in P.E. improved because of the NASP (compared to 0% who said it worsened) (Figure 26), and 24% of instructors said that their students' overall academic performance improved because of the NASP (again, compared to 0% who said it worsened) (Figure 27).

### Q21. How has the NASP affected student attendance in PE class?

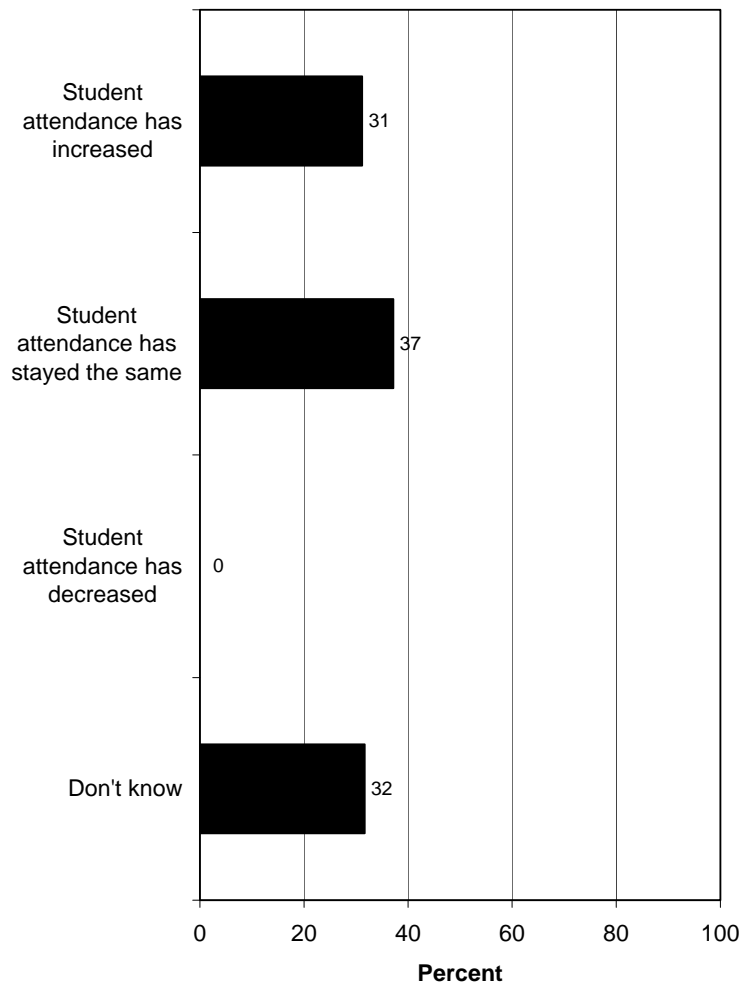
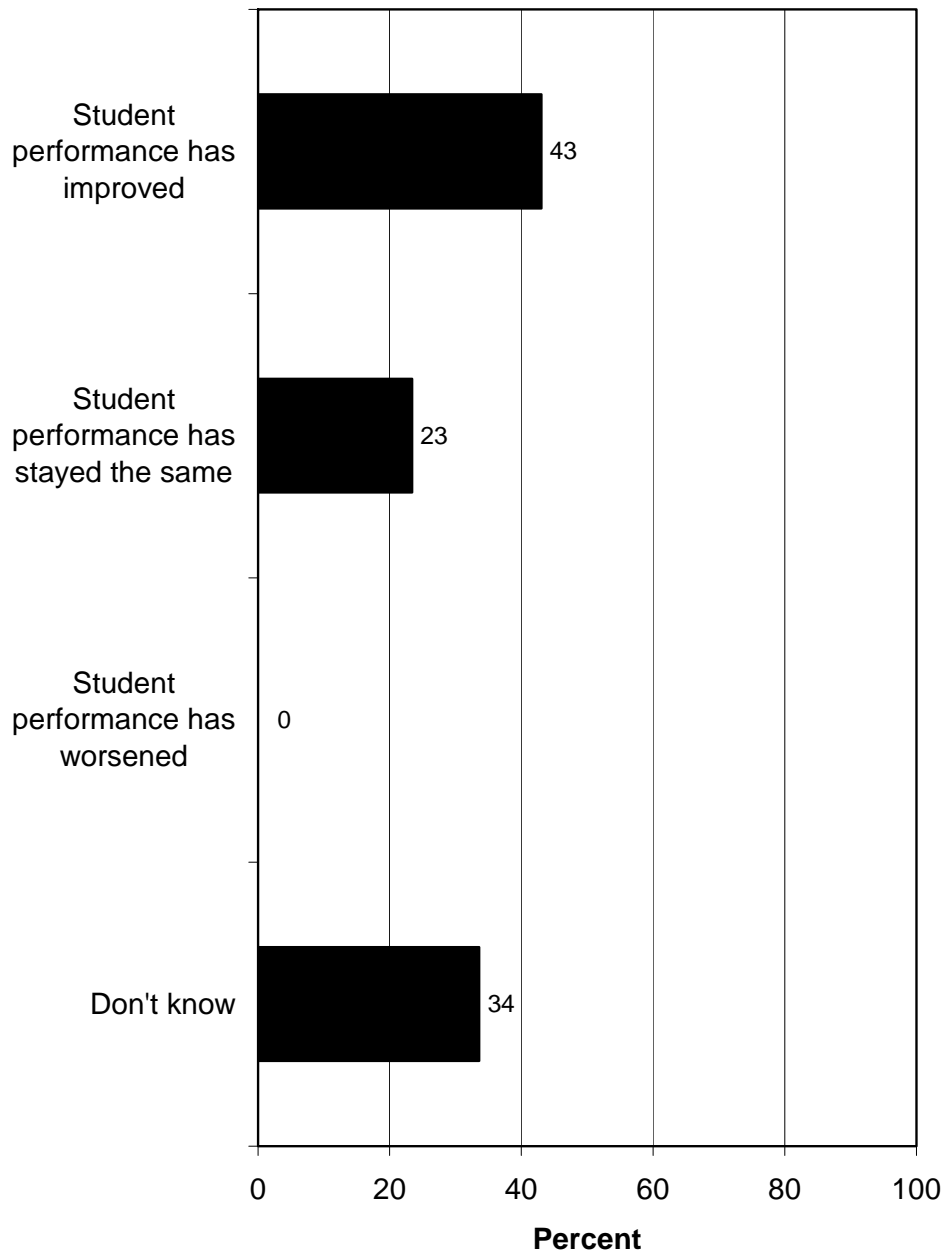


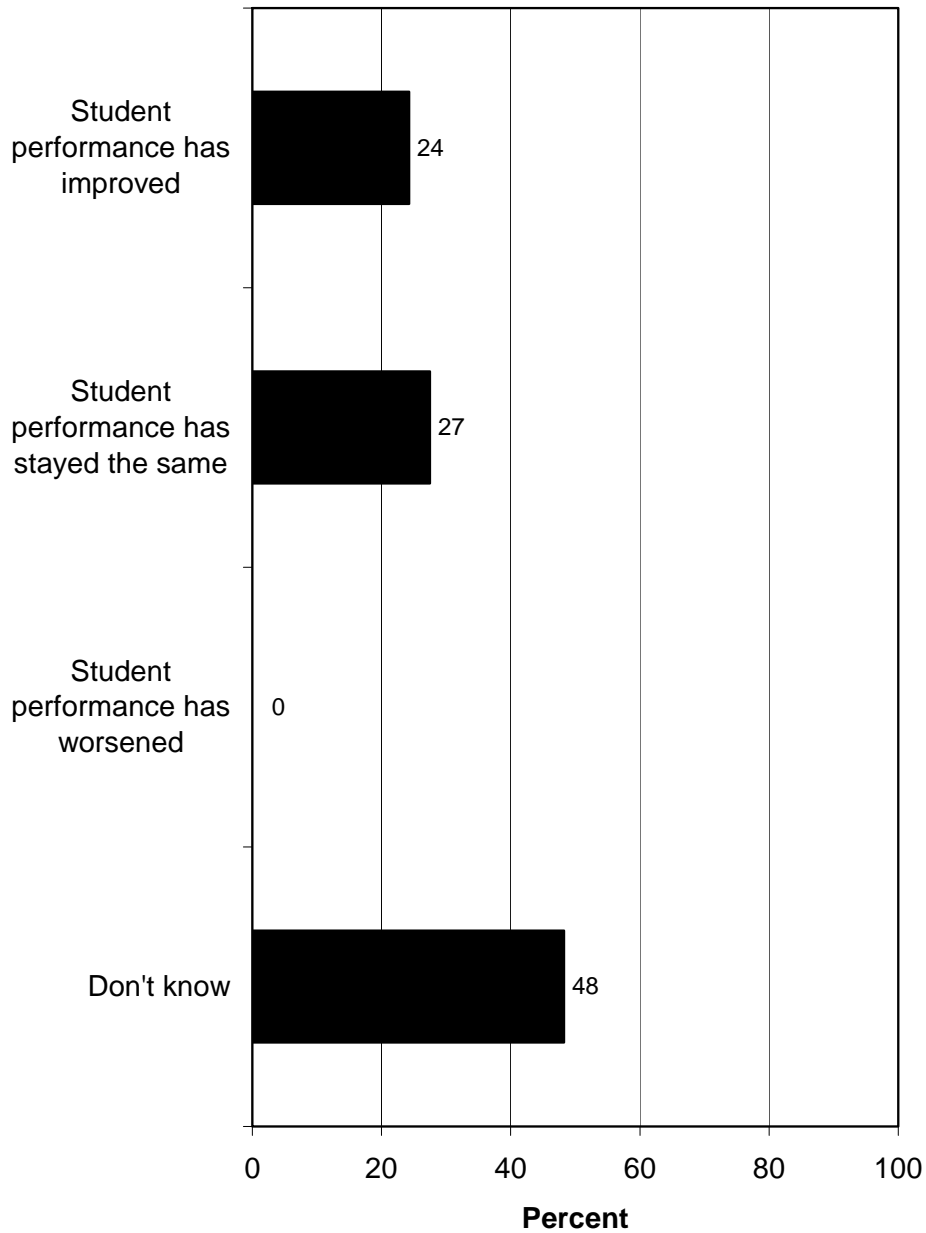
Figure 25. Instructors' Perceptions of the NASP's Effect on P.E. Attendance

**Q24. How has archery affected student academic performance in PE class?**



**Figure 26. Instructors' Perceptions of the NASP's Effect on School Attendance**

**Q23. How has the NASP affected overall student academic performance in school?**

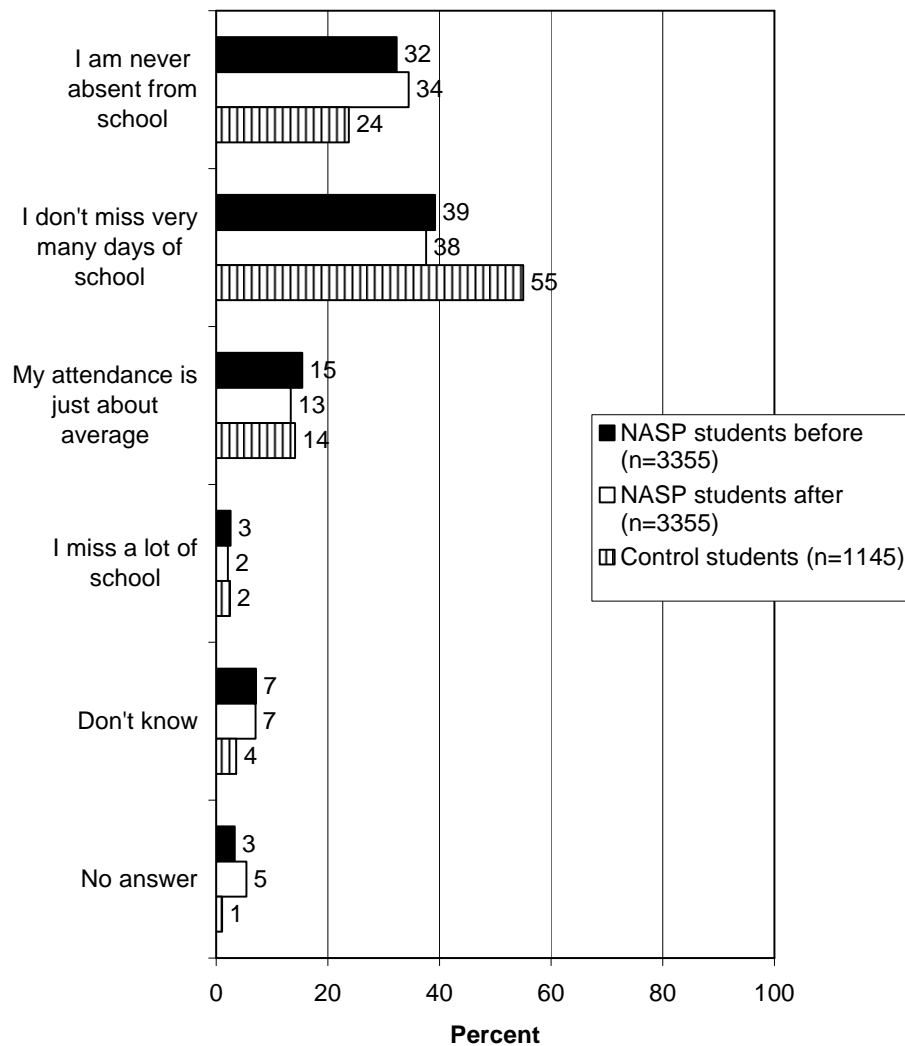


**Figure 27. Instructors' Perceptions of the NASP's Effect on Overall Academic Performance**

## Students' Perceptions of the NASP's Effects on Attendance and Academic Performance

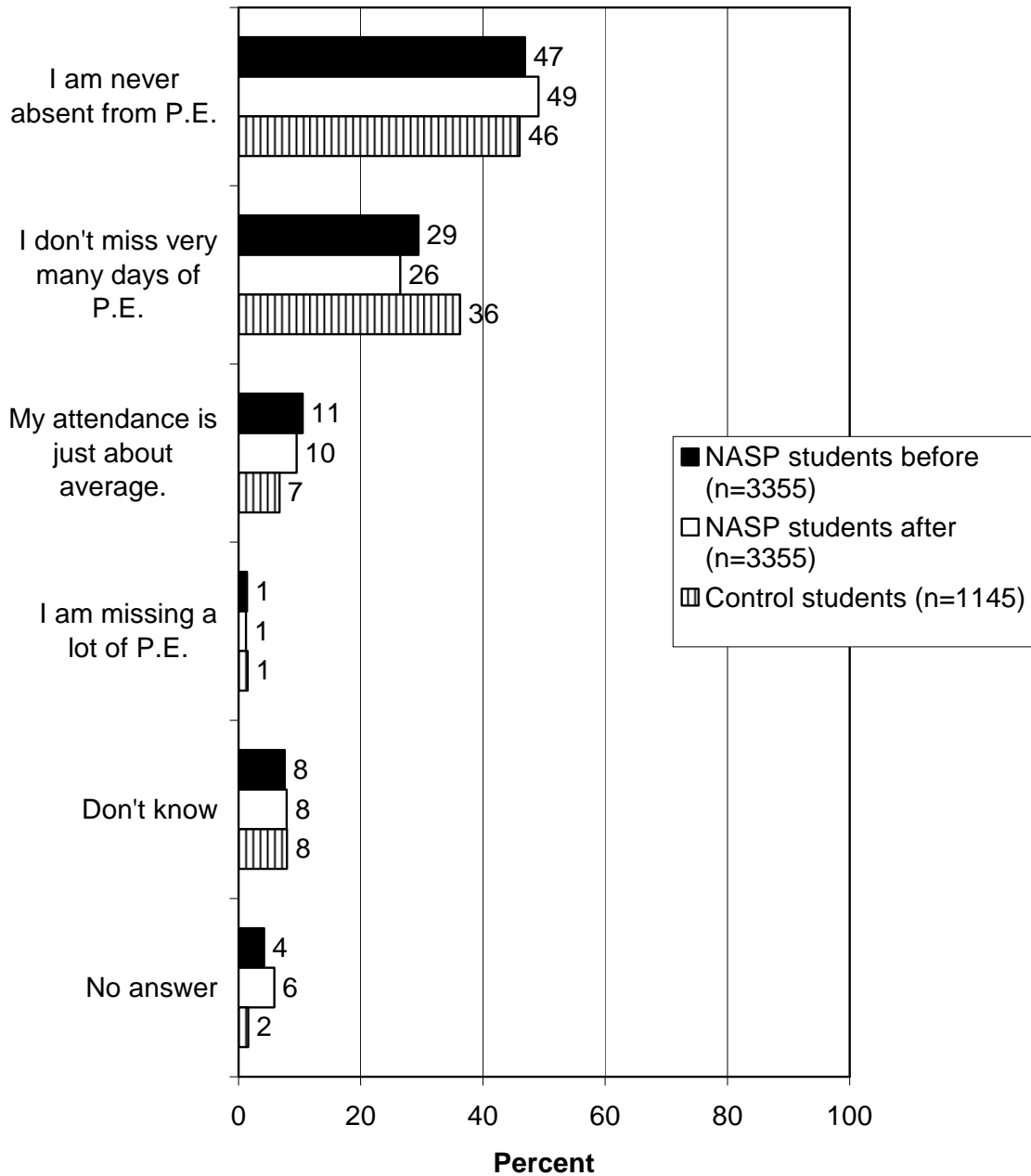
Other findings, however, do not show that the NASP positively affects attendance in school, nor in P.E. class, as shown in Figures 28 and 29 (although the findings show that NASP does *not* negatively affect attendance, either). Additionally, there is little evidence from the student surveys that the NASP positively affects academic performance. When asked to rate their performance in other classes before and after the archery program, a majority of NASP students rated their performance as excellent or good both before (65%) and after (66%) (Figure 30).

**Q16a/Q16b. How was your attendance in school before/after taking archery? / Q6. How is your overall attendance in school?**



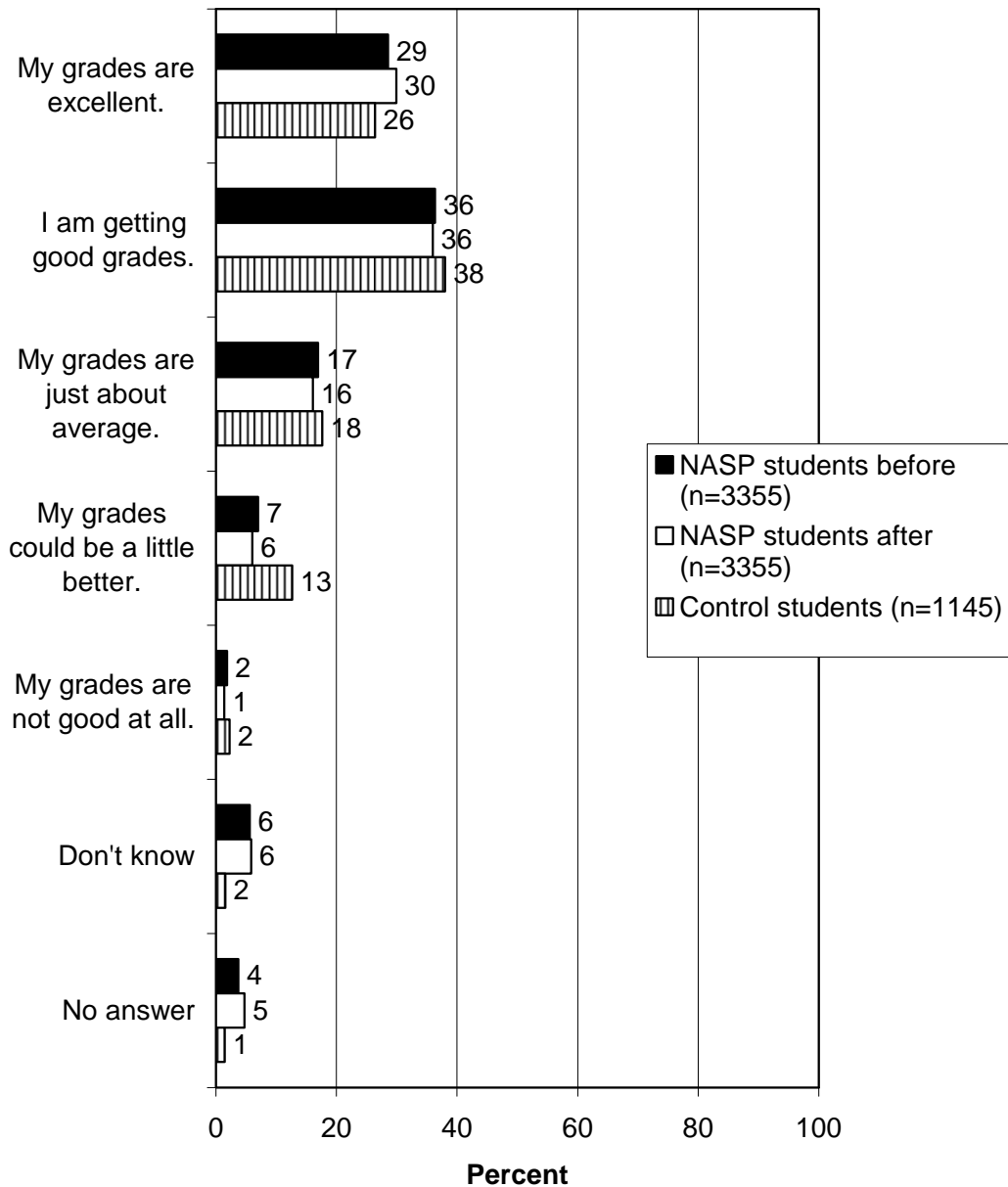
**Figure 28. Students' Self-Reported Attendance in School**

**Q19a/Q19b. How was your attendance in P.E. class before/after taking archery? / Q7. How is your overall attendance in P.E. class?**



**Figure 29. Students' Self-Reported Attendance in P.E. Class**

**Q23a/Q23b. How were/are you doing in your other classes before/after taking archery? /  
Q8. Overall, how are you doing in your classes?**



**Figure 30. Self-Reported Student Performance in Other Classes**

## An Analysis of Students' Grades

Phase III of this project examined actual grades of NASP students before and after the NASP. This analysis found almost no statistically significant effects of the NASP on grades. It is important to note, however, that (despite great efforts) only four teachers were able to participate in this part of the study. It may be that a greater sampling of teachers' classes would indicate some statistically significant changes in grades from pre-NASP to post-NASP. Specifically, this part of the analysis entailed four separate examinations of grades among various subgroups of the student population.

The first of these four examinations looked at the difference in the percentage of students as a whole and various subgroups of students receiving each grade (A through E), pre-program to post-program, for six subjects (reading, writing, English, math, science, and social studies/history). The calculation was made by taking the percentage of students who received each grade *after* the archery program and subtracting the percentage of students who received each grade *prior to* the archery program. In three subjects, some subgroups make better grades after archery: reading, English, and math. However, there are subgroups in all these subjects who do not make better grades. For the remaining subjects (writing, science, and social studies/history), almost all subgroups show no increase in grades after archery.

The second part of this analysis of grades looked at the mean grades and differences in the means for each subject among various groups of male and female students, pre-program to post-program. Some subgroups showed improvement in grades after archery, while others did not. However, one overall finding that was immediately apparent was how few subgroups had changes of more than 1.0 points that were statistically significant. In short, very few subgroups appeared to be markedly affected by the archery program.

The third part of the analysis of grades looked at mean grades for each of six subjects (reading, writing, English, math, science, and social studies/history) and the differences in the means, pre-program to post-program, for students as a whole and then according to the length of the archery program (one semester or longer; shorter than one semester). Only three increases were found, all among students who had an archery course that was one semester or longer: in reading, writing, and English (Table 3). Otherwise, every row in Table 3 shows a decrease in mean grades. Note that changes in the mean grade of more than 1.0 points that are also statistically significant at the  $p \leq 0.001$  level (the statistical significance depends on the size and variance of the sample) are shaded in gray.

**Table 3. Students' Mean Grades Crosstabulated by Length of Course**

Students' Mean Grades Pre-Program and Post-Program					
Subject	Length of Course	Pre-Program	Post-Program	Significance <sup>1</sup>	Change
Reading	All students	85.43	85.43	$p \leq 0.001$	0.00
	Less than 1 semester	85.75	85.39	$p \leq 0.001$	-0.36
	1 semester or longer	84.15	85.56	$p \leq 0.001$	1.41
Writing	All students	85.37	85.16	$p \leq 0.001$	-0.21
	Less than 1 semester	86.45	85.75	$p \leq 0.001$	-0.70
	1 semester or longer	81.53	83.03	$p \leq 0.001$	1.50
English	All students	85.00	84.94	$p \leq 0.001$	-0.06
	Less than 1 semester	86.10	85.57	$p \leq 0.001$	-0.53
	1 semester or longer	81.66	83.02	$p \leq 0.001$	1.36
Math	All students	80.93	80.29	$p \leq 0.001$	-0.64
	Less than 1 semester	79.76	79.75	$p \leq 0.001$	-0.01
	1 semester or longer	84.28	81.85	$p \leq 0.001$	-2.43
Science	All students	84.52	83.64	$p \leq 0.001$	-0.88
	Less than 1 semester	82.92	82.15	$p \leq 0.001$	-0.77
	1 semester or longer	89.07	87.88	$p \leq 0.001$	-1.19
Social Studies/ History	All students	83.91	83.09	$p \leq 0.001$	-0.82
	Less than 1 semester	83.37	82.66	$p \leq 0.001$	-0.71
	1 semester or longer	85.42	84.27	$p \leq 0.001$	-1.15
Overall Grades	All students	83.99	83.60	$p \leq 0.001$	-0.39
	Less than 1 semester	83.78	83.26	$p \leq 0.001$	-0.52
	1 semester or longer	84.59	84.54	$p \leq 0.001$	-0.05

<sup>1</sup>Significance refers to the statistical significance of the analysis and was dependent on the size and variance of the sample; it does not refer to a statistically significant *change*.

The final part of this analysis of grades examined mean grades for each of the six academic subjects and the differences in the means, pre-program to post-program, for students as a whole and then among students who had one of four teachers (the four teachers who were able to cooperate in this part of the analysis). The results showed that students of Teacher #2 (the teachers are not identified by name to protect the anonymity of survey participants) had a statistically significant increase in mean grades of more than 1.0 points in reading, writing, and English (Table 4). However, this was counterbalanced by statistically significant decreases of more than 1.0 points in math, science, and social studies/history among students of Teacher #2. There were no other statistically significant changes of more than 1.0 points for any of the other three teachers. In overall grades, only one teacher had students who made better grades post-program, but the increase was less than 1.0 points.

**Table 4. Students' Mean Grades Crosstabulated by Teacher**

Students' Mean Grades <b>Overall</b> Pre-Program and Post-Program				
	Pre-Program	Post-Program	Significance <sup>1</sup>	Change
All Students	83.99	83.60	$p \leq 0.001$	-0.39
Teacher #1	82.31	81.81	$p \leq 0.001$	-0.50
Teacher #2	85.46	85.36	$p \leq 0.001$	-0.10
Teacher #3	78.64	78.95	$p = 0.210$	0.31
Teacher #4	85.25	84.72	$p \leq 0.001$	-0.53
Students' Mean Grades in <b>Reading</b> Pre-Program and Post-Program				
All Students	85.43	85.43	$p \leq 0.001$	0.00
Teacher #1	83.72	83.47	$p \leq 0.001$	-0.25
Teacher #2	84.15	85.56	$p \leq 0.001$	1.41
Teacher #3	n/a	n/a	n/a	n/a
Teacher #4	87.77	87.31	$p \leq 0.001$	-0.46
Students' Mean Grades in <b>Writing</b> Pre-Program and Post-Program				
All Students	85.37	85.16	$p \leq 0.001$	-0.21
Teacher #1	84.82	83.99	$p \leq 0.001$	-0.82
Teacher #2	81.53	83.03	$p \leq 0.001$	1.50
Teacher #3	n/a	n/a	n/a	n/a
Teacher #4	88.07	87.52	$p \leq 0.001$	-0.55
Students' Mean Grades in <b>English</b> Pre-Program and Post-Program				
All Students	85.00	84.94	$p \leq 0.001$	-0.06
Teacher #1	84.27	83.73	$p \leq 0.001$	-0.54
Teacher #2	82.44	83.89	$p \leq 0.001$	1.45
Teacher #3	76.65	77.43	$p = 0.418$	0.78
Teacher #4	87.92	87.41	$p \leq 0.001$	-0.51
Students' Mean Grades in <b>Math</b> Pre-Program and Post-Program				
All Students	80.93	80.29	$p \leq 0.001$	-0.64
Teacher #1	78.35	78.36	$p \leq 0.001$	0.01
Teacher #2	86.09	83.15	$p \leq 0.001$	-2.94
Teacher #3	71.74	72.83	$p = 0.570$	1.09
Teacher #4	81.17	81.14	$p \leq 0.001$	-0.03
Students' Mean Grades in <b>Science</b> Pre-Program and Post-Program				
All Students	84.52	83.64	$p \leq 0.001$	-0.88
Teacher #1	82.33	81.43	$p \leq 0.001$	-0.90
Teacher #2	90.54	89.25	$p \leq 0.001$	-1.29
Teacher #3	79.21	78.71	$p = 0.292$	-0.50
Teacher #4	83.52	82.88	$p \leq 0.001$	-0.64
Students' Mean Grades in <b>Social Studies or History</b> Pre-Program and Post-Program				
All Students	83.91	83.09	$p \leq 0.001$	-0.82
Teacher #1	82.58	82.10	$p \leq 0.001$	-0.48
Teacher #2	87.03	85.59	$p \leq 0.001$	-1.44
Teacher #3	74.67	75.42	$p = 0.215$	0.75
Teacher #4	84.16	83.22	$p \leq 0.001$	-0.94

<sup>1</sup>Significance refers to the statistical significance of the analysis and was dependent on the size and variance of the sample; it does not refer to a statistically significant *change*.

## **Conclusions About Hypothesis 4: Archery Positively Affects Student Attendance and Performance in School**

The data are inconclusive regarding Hypothesis 4, with some results suggesting a positive effect, while other results do not show any effect. The data from the student survey shows that attitudes toward school are positively affected, which may lead to better attendance and performance in the long run. Specifically, NASP students are about eight times more likely to say that archery makes school better (33%) than to say that archery makes school worse (4%). Also, the percentage of NASP students who look forward to going to school more (33%) on days that they have archery exceeds the percentage of students who look forward to going to school less (10%) by more than three times.

The instructors' survey also obtained some evidence that the NASP has a beneficial effect on attendance and academic performance. About a third of instructors (31%) report that attendance in P.E. class increases because of the NASP, while 0% indicate it decreases. Instructors' responses to two questions regarding academic performance suggests some academic benefit from the NASP as well: 43% of instructors say that their students' performance in P.E. improves because of the NASP (compared to 0% who say it worsens), and 24% of instructors say that their students' overall academic performance improves because of the NASP (again, compared to 0% who say it worsens).

Other findings, however, do not show that the NASP positively affects attendance in school, nor in P.E. class. There is little difference in self-reported student attendance before and after the NASP. Self-reported academic performance, also, does not show any marked change pre-NASP to post-NASP. When asked to rate their performance in other classes before and after the archery program, a majority of NASP students rate their performance as excellent or good both before (65%) and after (66%).

Finally, the analyses of grades, which entailed four separate analyses, shows mixed results, with some groups of students improving their grades and others showing no improvement. Most of the results, however, of the analyses of grades do not show improvement.

#### IV. IMPLICATIONS AND RECOMMENDATIONS

The data obtained in this project show positive results regarding three of the four hypotheses. Hypothesis 1, which states that archery is engaging to students, is clearly supported by the student and instructor surveys. In short, nearly all measures of engagement show that students are, indeed, engaged by the archery program.

Hypothesis 2, which states that the NASP helps improve students' learning skills, in and outside of P.E., is also fairly well supported by the data. The data show that students' self-confidence is certainly improved. Students also feel that they learn to concentrate and focus better, which carries over into other aspects of their academic experience. The evidence suggests that they are more motivated in school, as well. Based solely on Hypothesis 2, it would appear that the NASP is beneficial to students.

The results for Hypothesis 3, which states that the NASP increases students' interest and involvement in archery, which in turn also increases family interest, suggest that students' interest in archery is increased. Additionally, it appears that their interest in other shooting sports is increased. Based on the link between physical activity and a well-rounded academic experience that the review of past research demonstrated, this increased interest in archery and shooting sports could have a potentially beneficial effect on students. On the other hand, family interest in archery does not appear to be greatly affected by students' participation in archery, although there is a small increase in family interest.

The data on Hypothesis 4 are mixed. While it appears that students have better attitudes toward school as a result of the NASP—which one would intuitively think would lead to better attendance in the long run—the data do not show a statistically significant link. Nonetheless, the positive results in self-reported attendance and academic performance because of the NASP suggest that further study be conducted before any definitive statement can be made on the effect that the NASP has on attendance and performance. Certainly, a better attitude among students can only help with attendance and academic performance.

Overall, the study indicates that the NASP has many benefits for schools. Three of the four hypotheses are well supported, and there are some positive results regarding some elements of the fourth hypothesis. It would appear that the program proves its value based simply on having the second hypothesis supported alone. The fact that three of the four hypotheses are supported by the data, and that the fourth has positive results regarding some elements, is compelling evidence of the overall value of the program. Furthermore, it is worth noting that the fourth hypothesis was not *disproved*, as it had mixed results, including some quite positive results regarding some of its aspects—including the fact that students appear to have a better attitude about school itself.

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## **ABOUT RESPONSIVE MANAGEMENT**

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Utilizing its in-house, full-service, computer-assisted telephone and mail survey center with 45 professional interviewers, Responsive Management has conducted more than 1,000 telephone surveys, mail surveys, personal interviews, and focus groups, as well as numerous marketing and communications plans, need assessments, and program evaluations on natural resource and outdoor recreation issues.

Clients include most of the federal and state natural resource, outdoor recreation, and environmental agencies, and most of the top conservation organizations. Responsive Management also collects attitude and opinion data for many of the nation's top universities, including the University of Southern California, Virginia Tech, Colorado State University, Auburn, Texas Tech, the University of California—Davis, Michigan State University, the University of Florida, North Carolina State University, Penn State, West Virginia University, and others.

Among the wide range of work Responsive Management has completed during the past 20 years are studies on how the general population values natural resources and outdoor recreation, and their opinions on and attitudes toward an array of natural resource-related issues. Responsive Management has conducted dozens of studies of selected groups of outdoor recreationists, including anglers, boaters, hunters, wildlife watchers, birdwatchers, park visitors, historic site visitors, hikers, and campers, as well as selected groups within the general population, such as landowners, farmers, urban and rural residents, women, senior citizens, children, Hispanics, Asians, and African-Americans. Responsive Management has conducted studies on environmental education, endangered species, waterfowl, wetlands, water quality, and the reintroduction of numerous species such as wolves, grizzly bears, the California condor, and the Florida panther.

Responsive Management has conducted research on numerous natural resource ballot initiatives and referenda and helped agencies and organizations find alternative funding and increase their memberships and donations. Responsive Management has conducted major agency and organizational program needs assessments and helped develop more effective programs based upon a solid foundation of fact. Responsive Management has developed websites for natural resource organizations, conducted training workshops on the human dimensions of natural resources, and presented numerous studies each year in presentations and as keynote speakers at major natural resource, outdoor recreation, conservation, and environmental conferences and meetings.

Responsive Management has conducted research on public attitudes toward natural resources and outdoor recreation in almost every state in the United States, as well as in Canada, Australia, the United Kingdom, France, Germany, and Japan. Responsive Management routinely conducts

surveys in Spanish and has also conducted surveys and focus groups in Chinese, Korean, Japanese, and Vietnamese.

Responsive Management's research has been featured in most of the nation's major media, including CNN, ESPN, *The Washington Times*, *The New York Times*, *Newsweek*, *The Wall Street Journal*, and on the front pages of *The Washington Post* and *USA Today*.

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