



*Original Research*

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## **Students' Perceptions of an Applied Research Experience in an Undergraduate Exercise Science Course**

REGIS C. PEARSON<sup>†</sup>, K. JASON CRANDALL<sup>‡</sup>, KATHRYN DISPENNETTE<sup>†</sup>,  
and JILL M. MAPLES<sup>‡</sup>

School of Kinesiology, Recreation, and Sport, Western Kentucky University,  
Bowling Green, KY, USA

<sup>†</sup>Denotes graduate student author, <sup>‡</sup>Denotes professional author

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### ABSTRACT

*International Journal of Exercise Science 10(7): 926-941, 2017.* Applied research experiences can provide numerous benefits to undergraduate students, however few studies have assessed the perceptions of Exercise Science (EXS) students to an applied research experience. The purpose of this study was two-fold: 1) to describe the rationale and implementation of an applied research experience into an EXS curriculum and 2) to evaluate EXS undergraduate students' perceptions of an applied research experience. An EXS measurement course was chosen for implementation of an applied research experience. The applied research experience required groups of students to design, implement, and evaluate a student-led research project. Fourteen questions were constructed, tailored to EXS undergraduate students, to assess students' perceptions of the experience. Qualitative analysis was used for all applicable data, with repeated trends noted; quantitative data were collapsed to determine frequencies. There was an overall positive student perception of the experience and 85.7% of students agreed an applied research experience should be continued. 84.7% of students perceived the experience as educationally enriching, while 92.8% reported the experience was academically challenging. This experience allowed students to develop comprehensive solutions to problems that arose throughout the semester; while facilitating communication, collaboration, and problem solving. Students believed research experiences were beneficial, but could be time consuming when paired with other responsibilities. Results suggest an applied research experience has the potential to help further the development of EXS undergraduate students. Understanding student perceptions of an applied research experience may prove useful to faculty interested in engaging students in the research process.

**KEY WORDS:** Applied research, undergraduate research, exercise science, student perception

### INTRODUCTION

Colleges and universities actively encourage faculty to use high-impact, educational practices to better engage undergraduate students. High-impact educational practices include learning communities, service-learning, writing-intensive courses, capstone experiences, and applied

research experiences (12). Applied research experiences directly address the goals of the Association of American Colleges and Universities by: providing students multiple opportunities to engage in “inquiry-based learning”, learning how to find and evaluate evidence, considering and assessing competing interpretations, and communicating persuasively (5). Engaging students in inquiry-based learning, via applied research experiences, is a particularly effective strategy to connect key classroom concepts and questions with active involvement in the research process. These experiences can promote better grades and increase perceived satisfaction with the educational experience (1). Student motivation and expectations can influence the relationships of the skills they develop (7), allowing them to develop a better understanding of course content, increase self-confidence, and report being more self-driven to develop problem solving skills and higher order thinking (6,10). Previous research has suggested that students participating in applied research experiences have a higher perception of their ability to act as a leader, understand scientific findings, analyze literature critically, and possess clear career goals compared to students with no research experience (1).

Applied research experience inserted into an undergraduate career, specifically in the early years, allows for students to increase research-specific and other transferable skills (8). Thus, applied research experiences prepare students for successful transition into post-baccalaureate graduate studies and/or a professional career. In fact, undergraduate students that engage in applied research experiences are significantly more likely to continue education past a bachelor’s degree and are twice as likely to complete a doctoral degree (1). Applied research experiences play a chief role in providing students with a context of learning to enhance knowledge and develop skills, which encourages more students to pursue postgraduate research careers and/or continue their professional education (16). Additionally, applied research experiences have the potential to develop two broad, transferable skill sets: hard skills and soft skills. Examples of hard skills include writing effectively, analyzing literature critically, and thinking logically about complex material (1). Examples of soft skills include teamwork and cooperation, interpersonal communication, and time management. Applied research experiences that incorporate a group aspect have the potential to develop numerous soft skills such as teamwork, collaboration, and adaptability. Graduating from an undergraduate program with perceived mastery of hard and soft skills allows graduates to contribute to their career field and improve their opportunity to obtain a job in their desired field of study (1, 17). These two skills sets have been identified as major competencies in nearly all professions (15).

Many science, technology, engineering, and mathematics (STEM) undergraduate and graduate programs offer applied research experiences for students and examples of implementation strategies into STEM curriculum have been previously published (7, 13, 14). Multiple research groups have outlined the benefits of undergraduate students’ engagement in applied research experiences within STEM programs; these include personal and professional growth (7), enhancement of educational experiences (14), and supporting the interests of the student to peruse a career in science (14). Seymour et al. (20) found an overwhelmingly positive student response referencing gains from their involvement with an applied research experience within

a STEM program. Another study found similar results in regards to student benefits related to applied research experiences in a STEM laboratory course, even when students were not familiar with the subject and inexperienced with experimental methods (17). There is less evidence that exercise science-related disciplines regularly offer these experiences. Given that exercise science-related disciplines are grounded in theory, but emphasize the practical application of theory, the incorporation of applied research experiences into the curriculum would allow the opportunity for the practical application of theory and scholarship within the discipline. To our knowledge, only two groups have described aspects of incorporating an applied research experience into an exercise science-related undergraduate curriculum. A recent paper published by Lee et al. (13) outlines a general 12-step guide for the implementation of an abbreviated applied research experience into an undergraduate course. Another paper by FitzPatrick and Campisi (5) describes how an applied research experience, incorporated into an exercise physiology course, reinforced and extended skills learned in previous course work, while offering an interesting, dynamic and challenging experience for students.

Positive perceptions of educational opportunities have a beneficial impact on student performance and, similarly, the inverse is found as well (4). While integrating an applied research experience into an exercise science-related, undergraduate curriculum has the potential for numerous educational benefits (5), no study has investigated student perceptions of courses that have integrated this high-impact practice in exercise science-related disciplines. This is important because previous work suggests that students across different disciplines may experience the benefits of research experiences differently (3). A better understanding of how students perceive the integration of an applied research experience can help guide the successful integration of this high-impact educational strategy into an exercise science-related undergraduate curriculum. Therefore, the purpose of this manuscript is two-fold: 1) to describe the rationale for and implementation of an applied research experience into an Exercise Science (EXS) curriculum and 2) to evaluate EXS undergraduate students' perceptions of the applied research experience.

## METHODS

In the Fall of 2014, a course titled, EXS 324 - *Measurement and Evaluation in Kinesiology*, was chosen for implementation of an applied research experience. Originally, this course was designed to help students understand the measurement process and applications of statistics in EXS. Topics included understanding, calculating, and evaluating validity, introduction of practical inferential statistics for the physical activity and health professions, devising tests, and measuring physical fitness. Unfortunately, students at that time did not have an opportunity to apply what they were learning outside the classroom setting because few formal research experiences were available for undergraduate EXS students at Western Kentucky University.

To address this problem, an applied research experience was incorporated into the course. The applied research experience required groups of students to design, implement, and evaluate a

student-led research project. The experience was comprehensive in that students collected data, constructed a formal written report of the project (including Introduction, Literature Review, Methods, Results, and Discussion sections), and presented their work in poster format.

The primary objectives for including an applied research experience in the EXS curriculum were: 1) to engage students to develop a better understanding of course content via active participation and application and 2) to promote the cultivation of hard and soft skill sets.

Key course topics included: an overview of measurement and assessment tools in the field of exercise science, analysis and interpretation of quantitative information, statistical analysis tools commonly used in exercise science-related fields, and an overview of the research process (including literature review, hypothesis generation, methods and data collection, data analysis and interpretation, etc.). In order to apply the students' knowledge of measurement and assessment tools in the field of exercise science, students were instructed to develop their own research questions along with support of a formal Methods description for their research project. The development of a Methods section required students to carefully select appropriate assessment tool(s) that would allow them to assess their primary research objective(s). One aspect of the applied research experience required students to collect and analyze their own original data. This experience provided the students with the opportunity to practically apply their knowledge of the tools and techniques commonly used in exercise science-related fields to analyze and interpret data. The opportunity for students to conduct an applied research experience, starting with the initial conception of the research question to presenting the final results, allowed the students to experience the entire research process from beginning to end.

Specific, transferable hard and soft skills were prioritized and course tasks were designed to develop the targeted skills.

Targeted hard skills included:

- scientific writing
- critical analysis of literature
- data collection and analysis
- interpretation of results

Targeted soft skills included:

- interpersonal communication
- teamwork and professional etiquette
- conflict resolution
- effective communication to an audience

Course assessments were designed to meet the primary course objectives, which not only included learning the key course topics described earlier, but also included the development of targeted hard and soft skills. Students were instructed to submit a final project report that

included an Introduction, Literature Review, Methods, Results, and Discussion. These assignments were intended to enhance the following hard skills: scientific writing, critical analysis of literature, and interpretation of data. Because students collected original data, their data collection skills were developed as well. In order to enhance targeted soft skills of interpersonal communication and teamwork, students were required to work in groups. A team evaluation assessment (see Figure 1), adapted from previous work by Kahn (9) and Oakley et al. (18), was assigned for each individual upon project completion. This assessment was designed to promote accountability in terms of teamwork and professional etiquette. It consisted of a self-reported, individual evaluation and an evaluation of each team member relating to contributions to the project, effective communication, ability to accept constructive criticism, and other aspects contributing to the overall success of the project.

**Research Team Evaluation Form**

Write the name of each group member in a separate column. For each group member, indicate the degree to which you agree with the statements on the left, using a scale of 1-4 (1=strongly disagree; 2=disagree; 3=agree; 4=strongly agree). Total the numbers in each column.

Evaluation Criteria	Self-Evaluation	Group member:	Group member:	Group member:
Effective in discussions, good listener, capable presenter, proficient at diagramming, representing, and documenting work				
Attended group meetings regularly				
Displayed or tried to develop a wide range of skills in service of the project, readily accepted changed approach or constructive criticism.				
Was dependable and completed assignments well and on time				
Demonstrated cooperative and supportive attitude				
Contributed overall to the success of the project				
Carried a fair load of the group work				
Communicated effectively with other group members (and the group's teaching assistant)				
<b>TOTALS:</b>				

**FEEDBACK QUESTIONS (answer on the back of this page or on a separate page, typed)**

1. Please comment about your specific contributions to this project. What tasks did you do that aided in its completion? What were your most important contributions? In what ways (if any) might you have contributed more? How effectively did your group work?
2. Please comment about each group members' contributions to this project. Be sure that you discuss each group member individually, by name. What tasks did each group member do that aided in the projects' completion? What were their most important contributions? In what ways (if any) might each member have contributed more?
3. Identify any problems or disputes that occurred during your interactions.

How could disputes have been avoided and/or how were they resolved?

**Figure 1.** Research team evaluation assessment.

In order to develop conflict resolution skills, students were provided with a framework for resolving group disputes (see Figure 2) and permitted to “fire” a group member. This procedure for “firing” a group member was adapted from previous work published by others (9, 18). Fortunately, no student has been fired since implementing this procedure. Lastly, students were given the opportunity to enhance their ability to communicate with an audience by designing and presenting a research poster.

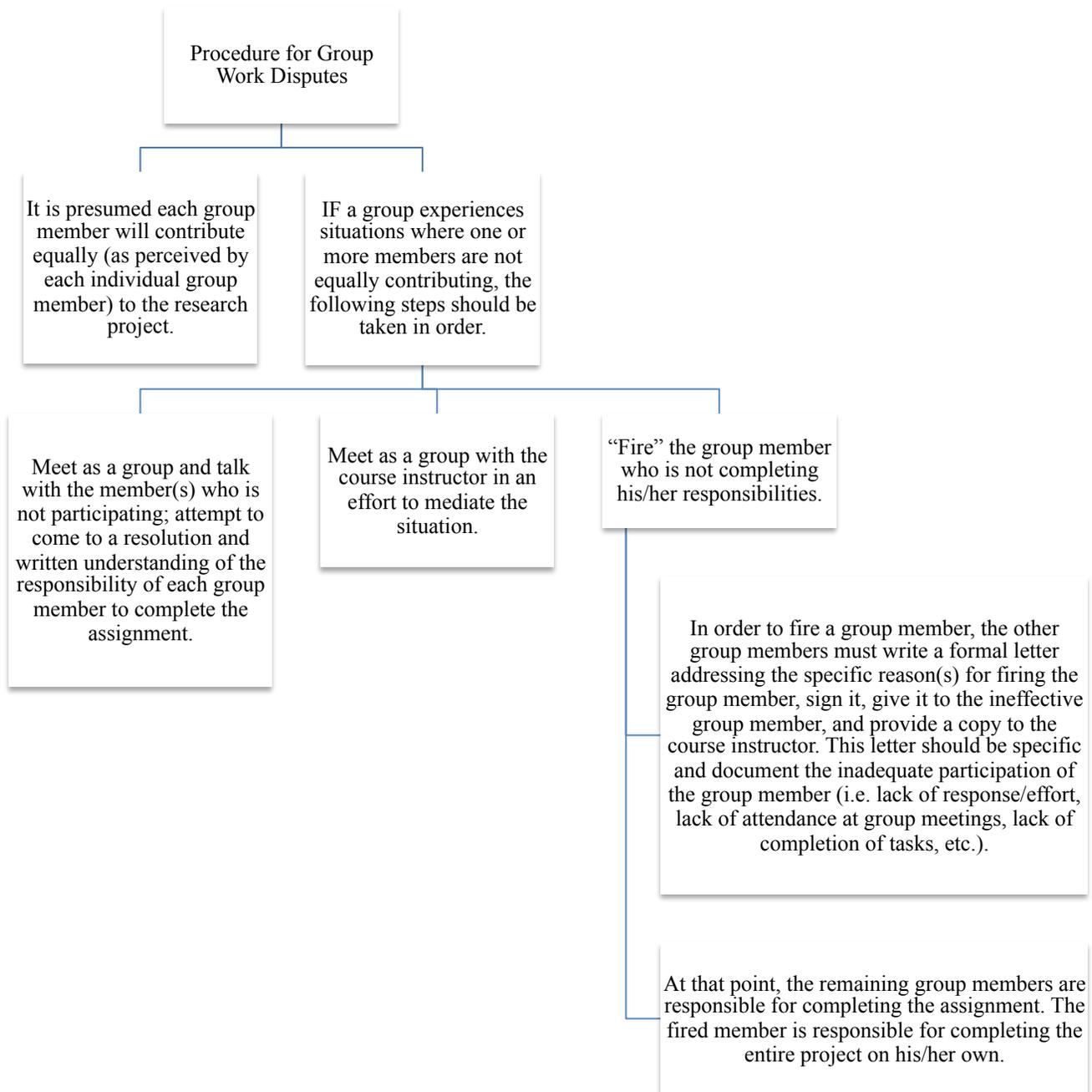
Consistent with the targeted course topics and skills to be developed, the following course learning outcomes were constructed: 1) demonstrating the ability to select and administer measurement and assessment tools in the field, 2) demonstrating the ability to make sense of quantitative information, 3) understanding and applying common descriptive and inferential statistics, and 4) demonstrating the ability to design a research project by collecting data, evaluating results, and presenting to a professional audience.

To help guide students through the applied research experience process, the project consisted of seven distinct steps:

Step 1: Groups of 4-5 students were instructed to choose a potential research topic of interest. Groups were provided a list of existing faculty research topics for possible collaboration or they could choose their own topic with approval from the instructor. Allowing flexibility in the research topic selection was intentional, as previous studies have indicated that providing students with a large variety of topic choices, results in students being less likely to randomly select a topic or feel pressured to select a topic in which they are less interested (13).

Step 2: To develop library search skills, the ability to identify primary academic sources, and research reading skills, each group was instructed to complete a Literature Review for their chosen topic. The Literature Review consisted of an introduction, body, and conclusion sections, referencing at least 10 primary articles.

Step 3: Students completed an overall Introduction to the research project based on findings from the Literature Review (described in Step 2). Research question(s) and hypotheses were included in the Introduction.



**Figure 2.** Procedures for group work disputes.

Step 4: Students completed a research proposal which included Introduction and Method sections through identifying independent and dependent variables. During this step, students were to identify the specific testing procedures, equipment needed, facilities for testing, and potential participants.

Step 5: Students completed the data collection process. They were given three options for data collection, the first being to collect data from fellow classmates, the second being to collect data from outside of the classroom, and finally students could use dummy data. If students chose to collect data from outside or inside the classroom, Institutional Review Board (IRB) approval was required. As an incentive, students who chose to complete the IRB process received a 5% bonus for the overall project.

Step 6: After data collection, each group chose the appropriate statistical test and confirmed with their research mentor or the instructor. This step allowed for the instructor to assess the development of the students in accordance with their ability to select appropriate statistical methods and analyze these data (13). Using Microsoft Excel or the Statistical Package for the Social Sciences (SPSS Version 24), students utilized many of the statistical procedures learned in the classroom. Some of the statistical procedures included Pearson correlation coefficient, paired and independent t-tests, ANOVA, and Chi-square. Additionally, students constructed appropriate tabular and/or graphical displays of their data, which they included in their written Results sections.

Step 7: Using Microsoft PowerPoint or Prezi presentation software, students constructed a professional research presentation that was presented to the rest of the class and faculty during the final week of the course.

Recent work by Visser-Wijnveen et al. (21) indicates that the measures of *quality, beliefs, motivation, reflection, participation, and current research*, accurately capture a student's perception of an applied research experience (21). Consistent with these findings, we constructed 14 questions to assess students' perceptions of the applied research experience, tailored to EXS undergraduate students (See Table 1). Of these questions, two were used to identify sample groups, three were yes or no, seven were scored on a 5-point Likert scale, and two were open-ended. Questions were categorized into a research integration scale, previously described by Visser-Wijnveen et al. (21). Students enrolled in the Spring 2014, Fall 2014, and Fall 2015 semesters were asked to respond to the questions.

Students enrolled in the Spring 2014, Fall 2014, and Fall 2015 sections of the course were given the opportunity to voluntarily complete online questions by clicking on a unique link via Qualtrics software. Approximately 29% (28 of 96) of the students completed the Qualtrics survey, which was a limitation to the study. Upon survey entry, the respondents were asked to read and electronically sign an informed consent form before continuing to answer the series of questions. To maintain anonymity, the students did not provide any identifying information. Students could choose to enter a drawing for a \$10 prize from the university bookstore at the end of the survey. Student anonymity was maintained by redirecting them to a separate survey to complete the entry form for the drawing. This study was approved by the WKU Institutional Review Board (IRB #743731-1).

**Table 1.** Online questions to assess student perceptions of the applied research experience.

Item	Type of answer	Research Integration Scale
Which semester did you take EXS 324: Measurement and Evaluation in Kinesiology?	Selected from three answer choices: (1) Spring 2014, (2) Fall 2014, or (3) Fall 2015	-
What grade did you receive in the course?	Selected from five answer choices: (1) A, (2) B, (3) C, (4) D, (5) F	-
Did you receive IRB approval to collect data for your research project?	Yes or No	Participation
Did you present/are you planning to present your research project outside of the classroom?	Yes or No	Participation
Should the research project be a requirement in EXS 324?	Yes or No	Reflection
Overall, my instructor was effective.	Likert Scale	Quality
Expectations and deadlines for the research project were clearly described.	Likert Scale with an option to provide comments	Quality
The research project was an enriching educational experience for me.	Likert Scale	Beliefs
The research project was academically challenging.	Likert Scale with an option to provide comments	Beliefs
The research project helped to create a more supportive learning environment for me and the other students.	Likert Scale with an option to provide comments	Motivation
The research project created greater interaction between you and the instructor.	Likert Scale with an option to provide comments	Participation
The research project changed my perception of the exercise science field in a positive way.	Likert Scale with an option to provide comments	Current Research
What would you change about the research project experience?	Open-ended answer	Beliefs
Was the research project conducive to your learning style?	Open-ended answer	Motivation

\*The Likert Scale for these questions had five options that the students would choose from: (1) Strongly agree, (2) Agree, (3) Neither agree nor disagree, (4) Disagree, (5) Strongly Disagree.

The qualitative data were evaluated independently by two unbiased researchers that were blinded to the survey development and study hypothesis. Each individually examined the data, interpreted the data forming an impression, reported their impressions from the data, and noted themes. After the independent analysis, the researchers then compared their results to mutually agree on common themes in the students' responses. Quantitative data were collapsed to determine frequencies.

**RESULTS**

The perceptions of an applied research experience among EXS undergraduate students enrolled in a course titled EXS 324 - *Measurement and Evaluation in Kinesiology* were evaluated. Of the 96 students enrolled in the course from the Spring 2014 through the Fall 2015, 28 students responded to the online questions. Of the 28 students that responded, 7 represented Spring 2014, 12 represented Fall 2014, and 9 represented Fall 2015. While our results are reported for these 28 students, these data may or may not represent all 96 students who were

enrolled in the course. This corresponds to a response rate of 20.0% in the Spring 2014, 31.6% in the Fall 2014, and 31.0% in the Fall 2015. These data may or may not represent all 96 students who were enrolled in the course during the three different semesters (i.e. Spring 2014, Fall 2014, and Fall 2015).

Of all respondents, the majority of students (60.7%) received IRB approval to collect data for their research project, with 21.4% planning to present their research project outside of the course (see Table 2). Additionally, 85.7% of respondents believed that an applied research experience should be continued within the course, compared to only 10.7% indicating that they did not think the research project should be a requirement.

**Table 2.** Total percentage of student responses to Yes or No questions.

Question	% of Student Responses	
	Yes	No
Did you receive IRB approval to collect data for your research project?	60.7	39.3
Are you planning to present your research project outside of the classroom?	21.4	78.6
Should the research project be a requirement in EXS 324?	85.7	10.7

Overall, 46.4% of respondents “strongly agreed” that their instructor was effective, compared to only 10.7% that “disagreed” (see Figure 3). The majority of students (57.1%) “strongly agreed” and an additional 32.1% “agreed” that expectations and deadlines were clearly described. 53.6% of respondents “strongly agreed” and an additional 31.1% “agreed” that the research project was an enriching educational experience. Almost 93% of the respondents (46.4% “strongly agreed” and 46.4% “agreed”) indicated that the project was academically challenging. Figure 3 represents student responses to the 5-point Likert scale questions.

Students had the opportunity to provide additional comments when presented with several of the 5-point Likert scale questions. There were 6 total comments in response to the question “The research project was academically challenging.” All 6 comments were interpreted as indicating students perceived the research project as academically challenging. Multiple responses included positive inferences including: “I’m glad I was able to experience a research project...”, “I felt this project was a great opportunity...”, “the research project helped me apply the topic...”, and “knowledge and experience gained from it will help me in the future.” Responses also revealed perceived difficulties in carrying out the research project including: “it was challenging at times...”, “The project was very time consuming and required extensive research and application...”, and “Finding group members volunteering their time outside of class was a struggle...”

Overall, the optional comments associated with Likert scale questions indicated that students felt the applied research experience was an effective learning tool, allowed them to develop a better understanding of the research process, and enabled them to learn about topics of their interest. Comments such as “... learned a lot...”, “...it was a great exercise and was effective...”, and “The project required active participation throughout the semester. In turn,

students developed interpersonal relationships...” implied that the students perceived the applied research experience was an effective learning tool. Students commented that they enjoyed learning about the research process, which is evidenced by comments such as: “The research project allowed me to develop a more comprehensive understanding of how research in the field of exercise science can be applied to a multitude of theories and models.” Lastly, some students expressed appreciation for the opportunity to learn about topics of interest to them. Comments such as “I love my EXS program and this project made me like it more.” indicate that the opportunity to learn about topics of their interest in the EXS field was perceived as positive by some students.

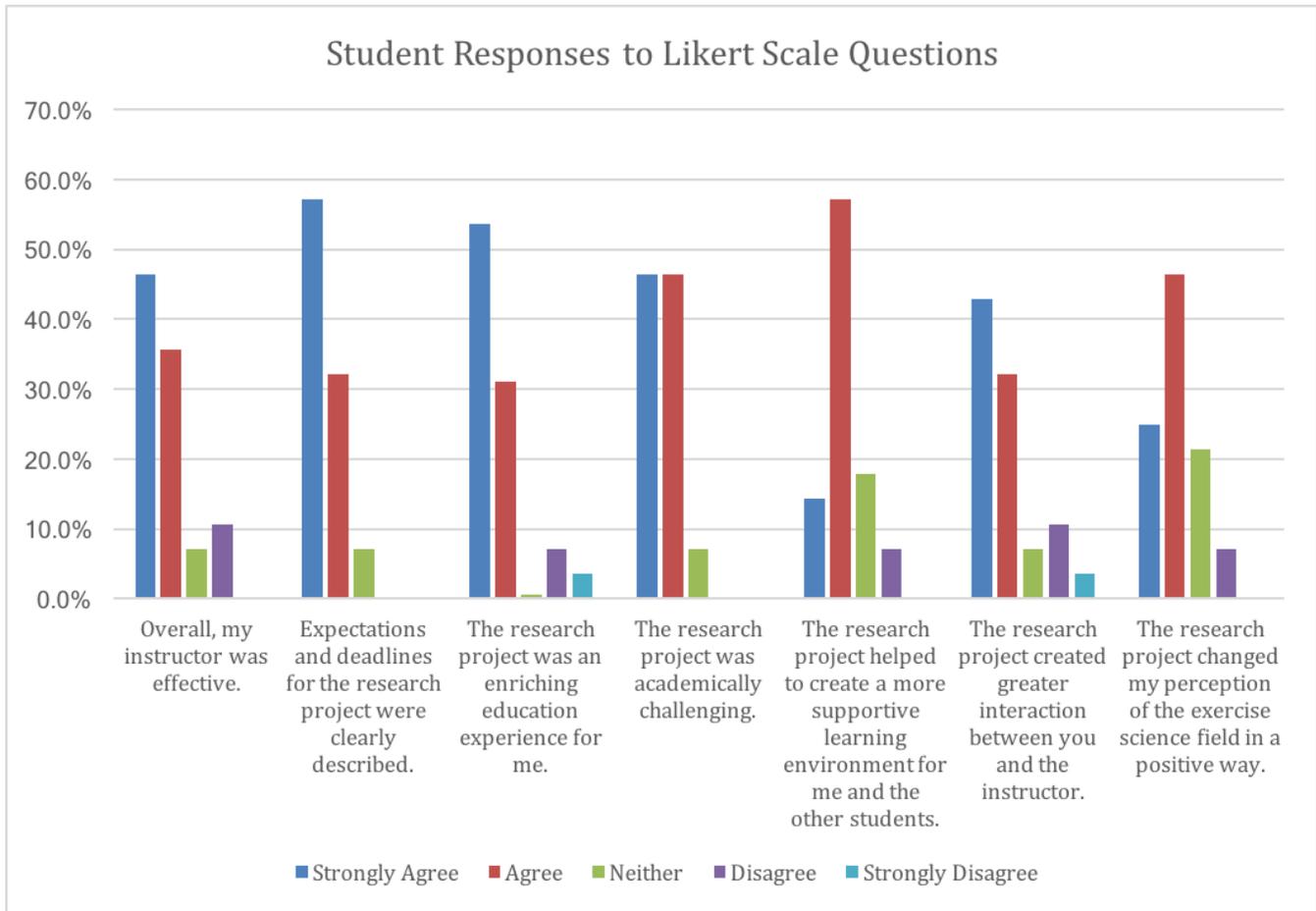


Figure 3. Student responses to Likert scale questions.

Students were asked two open-ended questions: 1) “What would you change about the research project experience?” and 2) “Was the research project conducive to your learning style?”. Common themes identified from the first open-ended question, regarding suggested changes to the research project experience, included: 1) references to the IRB process, 2) group member dynamics, and 3) time constraints. Three comments indicated students valued the IRB application experience and believed it should be a goal of all students participating in the applied research experience. Comments regarding group member dynamics reflected the difficulties of working in a group. For example, one student suggested “express the importance of working together as a group...”. Other students made similar comments

including: "I would have changed the members of my group...", "Group members rarely liked to work on the project outside of class...", and "My group had a few people that were unmotivated and were willing to only do the minimum...". Comments regarding time constraints indicated that students perceived a lack of time to work on the project as indicated by the following (and other similar comments): "I wish we would have had more time during the week...", "designate times the groups HAD to work on the project...", "If possible, I would enable students more time to complete research project...", and "The timeline. The way it was set up, we were rushed to wrap up the project... more beneficial to have less time for the introduction/ methods and more time to get data/results."

Responses from the second open-ended question, regarding how conducive the research project was to the student's learning style, were varied. Of the seven responses, three were positive and included comments such as: "a great way to get a hands on learning experience...", "I gain better understanding when I am hands on or working through the process myself ..." and "I enjoy projects that require me to think creatively while also using logic to develop comprehensive solutions to problems. This project was multidimensional, and while challenging, it created the opportunity for students to learn more about the field they were studying." Other responses indicated that students recognized some of the benefits of the research project, but still had reservations in terms of how conducive the experience was for them or even indicated that the learning experience was negative. One student listed several benefits of participating in the research experience but then concluded with "I just do not think it was a positive learning experience for me." Other comments indicated that the project was stressful but recognized it as "a new experience that helped me better understand the process..." of research. Another student commented that the experience was conducive "in some ways, but mostly my experience was negative from the class."

## **DISCUSSION**

This manuscript describes the rationale for and implementation of an applied research experience into an EXS curriculum, designed to enhance hard and soft skill development. Scarce literature regarding the incorporation of applied research experiences into exercise science-related disciplines exist. Given the overwhelming evidence previously reported by investigators describing the incorporation of applied research experiences into traditional STEM undergraduate courses (3, 7, 14, 20), the aim of this manuscript was to describe practical tools that could be used and/or adapted to incorporate applied research experiences into exercise science-related courses. We outlined seven steps that were successfully used to guide students through the applied research experience process. Additionally, we described the rationale for specific assessments designed to be consistent with primary course objectives, key course topics, and course learning outcomes.

Because perceptions of educational opportunities have a direct impact on student performance and engagement (4), another purpose of the manuscript was to evaluate students' perceptions of an applied research experience. Our results help to provide a qualitative understanding of how EXS undergraduate students perceived the implementation of an applied research

experience into an EXS undergraduate course. While students identified perceived challenges with the experience, several reported benefits of the experience. For example, a large majority (85.7%) of the responding undergraduate EXS students reported they believe the applied research experience should be continued in the EXS program (see Table 2). Perhaps the high percentage of positive student responses regarding the continuation of an applied research experience can be attributed to allowing students to develop a specific topic of interest within the EXS field, thus enabling students to explore career options. This is consistent with previous research which has shown that students having been engaged in applied research experiences perceive their experience as positively impacting their career path (3).

Overall, optional comments associated with Likert scale questions seemed to indicate that students perceived the applied research experience as an effective learning tool. Quantitative data indicated that almost 85% of students (53.6% “strongly agreed” and 31.1% “agreed”) that the research project was an enriching educational experience (see Figure 3). The opportunity to analyze and interpret data allowed them to practically apply what they were learning in the classroom. This suggests that (to some degree) the hard skills of data collection/analysis and the skill of interpreting results were practiced, although this was not directly measured in the study. Based on student responses to the optional comments associated with other Likert scale questions and the open-ended questions, students indicated that they were challenged to think creatively in order to develop comprehensive solutions to problems that arose throughout the semester. We speculate the soft skills of interpersonal communication and teamwork were practiced throughout the applied research experience as a result of conducting research within a research group. This speculation is supported by the emerging theme from an open-ended question identified as “group member dynamics.” Similar to FitzPatrick and Campisi (5), it was clear that some students perceived the applied research experience as an enriching educational opportunity that challenged them interpersonally.

Evidence suggests that the applied research experience was perceived as academically challenging. This finding is supported by both qualitative and quantitative data collected in response to the Likert scale question “The research project was academically challenging.” All optional comments in response to this question indicated students perceived the research project as academically challenging, which is consistent with quantitative data indicating that almost 93% of the respondents (46.4% “strongly agreed” and 46.4% “agreed”) perceived the project was academically challenging. These results coincide with other studies that have examined applied research experiences, specifically in STEM fields (7, 13, 14, 17). This parallel of similar student perceptions between EXS and STEM fields suggest that EXS students receive similar benefits as previously noted in other academic fields; these findings support the need for applied research experiences in the EXS field.

Although the responses to several questions assessing the perception of the applied research experience were positive, students did express some concerns. Some students suggested they felt overwhelmed by the combination of work required for the applied research experience and the course material. Students perceived more applied learning to be beneficial, but very time consuming when paired with coursework and other responsibilities. “Time constraints”

was identified as an emerging theme from one of the open-ended questions. One student suggested changing the layout of the class to include a one-hour lab would allow more time for group work and interaction with the instructor or a continuation of the project through an additional semester. Allowing additional time to conduct research has been previously reported as more beneficial overall in another study of undergraduate student perceptions of regarding applied research experiences (1). In the study by Bauer and Bennet (1), there was a strong relationship between length of time having participated in research and increased perceived benefit of the research experience. There are obvious logistical challenges associated with integrating a multi-semester applied research experience into an undergraduate EXS curriculum, however if feasible, there could potentially be numerous benefits including successful employment related to the students' field of study (1).

Another identified theme was students' concern with "group member dynamics". Several student comments indicated that they encountered some type of difficulty working in their respective groups. These comments reflect similar concerns, regarding perceptions of peer group dynamics, across many undergraduate applied research initiatives in multiple fields (11). Researchers attempted to combat this known group dynamics problem by allowing students to "fire" a group member through following a specific protocol (Figure 2) outlined in the beginning of the initiative (18). However, another study reported "personal interactions" as the second most valued outcome of an applied research experience, which included the development of friendships and relationships (3). While our results did not include specific references to this particular benefit, it is logical to speculate that some "group member dynamics" would prove to be difficult and challenging, while others would be more positive and beneficial.

One limitation to our study was the relatively small number of student responses. Approximately 29% (28 of 96) of the students completed the Qualtrics survey. The low number of responses could be due to the delayed administration of the survey. Also, because highly motivated responders, or students that received satisfactory grades, may be more likely to respond to the surveys (2), our results may be biased. Posing these questions during the last week of the semester may have improved the student response rate and thus limit the possibility of response bias. Another limitation to our study was the timing of online survey question development. Researchers speculate that designing a study around the initiative, or course, *ex ante* may improve cohesiveness between the initiative and the study's findings by limiting the time between the termination of the course and administration of the online survey. This study was initiated after the first cohort of students were exposed to the applied research experience.

In summary, this paper describes the rationale for and implementation of an applied research experience into an EXS curriculum and the students' perceptions of the integration of an applied research experience into an EXS course. The seven steps for guiding students through the applied research experience, along with the description of assessments designed to be consistent with primary course objectives, key course topics, and course learning outcomes, may provide a framework for faculty within exercise-science related disciplines to incorporate

applied research experiences into their curriculum. Understanding both the positive and negative perceptions of students regarding the implementation of applied research experiences may also prove useful for faculty interested in engaging students in the applied research process. Our results indicate most students believed the integration of an applied research experience into an EXS classroom is a valuable, but there is a need to address some negative aspects of the experience.

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