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Using the Power Balance Wristband to Improve Students' Research-Design Skills

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Abstract

We describe an exercise involving the power balance wristband (PBW) designed to enhance students' ability to design scientific tests. An instructor demonstrated that the PBW improved a student's balance, strength, and flexibility and invited students to design and conduct a brief scientific test of the PBW. Research methods students who participated in the exercise significantly improved their ability to design scientific tests of the PBW and another pseudoscientific practice (i.e., Healing Touch); students enrolled in the control sections of the course showed no improvement. Incorporating this single-class exercise into research methods courses has the potential to not only improve students' critical thinking about pseudoscience but also improve their research-design skills.

Keywords

pseudoscience, research methods, critical thinking

Teaching research methods courses can be difficult due to the complexity of the material and the fact that many students consider the content uninteresting (Burkley & Burkley, 2009; LoSchiavo & Roberts, 2005). Thus, instructors often search for ways to make these courses more interesting and effective. For example, Burkley and Burkley (2009) described the use of video clips from the television show *Mythbusters* to illustrate research-design concepts. Other authors have described incorporating pseudoscientific topics such as graphology (Boyce & Geller, 2002), facilitated communication (Stark, 2012), and voice-stress analysis (LoSchiavo & Roberts, 2005) into research methods courses. Incorporating topics related to pseudoscience and the paranormal into research methods courses might make them more interesting and fun and enhance students' critical thinking and research-design skills.

While many authors have focused on using pseudoscientific and paranormal topics to enhance students' critical thinking and scientific reasoning skills in research methods and other courses (e.g., Adam & Manson, 2014; Bates, 1991; Boyce & Geller, 2002; Lawson, 2003, 2007; Lawson & Crane, 2014; Lilienfeld, Lohr, & Morier, 2001; McLean & Miller, 2010; Stark, 2012; Wesp & Montgomery, 1998), relatively few have described using these topics to improve students' research-design skills. Exercises or projects that require students to develop scientific tests of pseudoscientific claims or products might be one way of enhancing students' research-design skills in a manner that is interesting and enjoyable for the students. As LoSchiavo and Roberts (2005) stated, "Because most pseudoscientific and parapsychological topics are inherently interesting, they are particularly well suited for testing in methods courses" (p. 178).

LoShiavo and Roberts (2005) had research methods students test the effectiveness of a voice-analysis program designed to detect deception. Although they reported that their students performed well on their midterm exam and their research reports, these data did not allow them to determine whether the voice-analysis activity improved students' research-design skills. In addition, the activity required 6 weeks of class time. In contrast, we were interested in examining whether relatively brief exercises involving pseudoscientific phenomena could be used to improve students' research-design skills. For example, Lawson and Crane (2014) described a demonstration of dowsing designed to improve introductory psychology students' critical thinking and understanding of ideomotor effects, and they suggested using similar demonstrations in research methods courses where instructors could invite students to design scientific tests of such pseudoscientific practices.

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To investigate the effects of incorporating pseudoscience into research courses for the purpose of enhancing students' research-design skills, we developed an exercise involving the power balance wristband (PBW), a popular silicone wristband with Mylar holograms that supposedly improve a person's balance, strength, and flexibility. Our students have expressed curiosity about the PBW, and we thought they would enjoy designing a test of the PBW's effectiveness. Because our research courses focus more on group-based research than on single-case research, we also utilized this opportunity to encourage students to apply their knowledge of research-design principles to single-case experiments.

Method

Participants and Procedure

The exercise. Students ($N = 42$) enrolled in one of the two laboratory sections of the second course in a two-course sequence that covers research design and statistics participated in the exercise. The same instructor conducted it in both sections during the 13th week of a 15-week semester (after covering research-design principles relevant to the exercise).

The instructor explained that they would do an exercise to apply their knowledge of research design to the evaluation of real-world claims and products. She displayed photographs of the PBW and explained that it "utilizes a Mylar holographic disc that can resonate with the body's energy field, optimizing the flow of energy around the body," "improves balance, strength, and flexibility," and "has been endorsed by professional athletes." Using a student volunteer, the instructor demonstrated that the PBW enhanced the student's balance, strength, and flexibility using the same three-test procedure shown in the PBW promotional videos (e.g., https://www.youtube.com/watch?v=6gIMxjr3n5U).[1,2]

After the demonstration, the instructor gave students a handout with questions asking them (a) for alternative explanations for the improvement in the student's balance, strength, and flexibility and (b) to design a scientific test (one that could be done in class in less than 10 min) of the PBW. She explained that she brought a small box of materials that could be used to conduct the test. To avoid giving the students any hints for the research design, she did not tell them what was in the box; it contained a control PBW (i.e., we removed the holograms), blindfold, masking tape (to cover the holograms for blind tests), and a binder clip (which could be used to clip the PBW to the back of a person's shirt for blind tests).

The instructor then briefly reviewed a PowerPoint slide that contained the following research-design concepts covered in previous class sessions: control groups (or a control condition or time period), control variables, order effects, chance effects (and the importance of multiple trials or replication), experimenter expectations (or intentional manipulation to make a bogus practice seem effective), subject expectations (e.g., placebo effect), and single- and double-blind procedures. Students got into small groups (four to five students) to discuss the tests they designed and choose the best design that incorporated the research-design concepts. Afterward, each group reported their design to the class. The instructor chose one of those designs and students conducted their test. Because we knew from previous classes in which we have used this exercise that at least one group typically mentions the use of a control PBW without the holograms (and the box contained a control PBW), the instructor chose that group to conduct the test. The students wrapped masking tape around the hologram areas of both PBWs (a double-blind test) and the instructor tried each one on a student volunteer. The students decided to conduct all three tests (balance, strength, and flexibility) with one wristband and then conduct all three tests with the second wristband (i.e., they determined which wristband to use first).

Afterward, the instructor asked the class whether the tests indicated that the PBW worked and reviewed whether their research design utilized all of the aforementioned research-design concepts. This provided an opportunity to point out any flaws in their design (e.g., it did not adequately control for order effects or chance effects). Finally, to help students generalize to pseudoscientific phenomena other than the PBW, the instructor presented an example involving the Feingold Diet (see Appendix A). The instructor asked the students to report out their ideas for a scientific test of the diet, and the whole class discussed and critiqued the ideas.[3]

Evaluation of the exercise. After the exercise (which took approximately 35 min), the instructor asked the students to complete a brief questionnaire. They rated, on a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), their agreement with statements that the demonstration was (a) informative and (b) interesting, that it (c) "helped me understand how to design a scientific test of a claim related to pseudoscience or the paranormal," and that they (d) would recommend using the same demonstration in future research courses. The questionnaire also had space for students' comments.

We also assessed the effect of the exercise on students' ability to design scientific tests of the three phenomena. In class periods 1 week before (pretest) and 1 week after the exercise (posttest), students read a case example supporting each of three pseudoscientific phenomenon (i.e., Healing Touch, subliminal persuasion, and the PBW; see Appendix B). Students explained how they would design a scientific test of each phenomenon. Blinded raters scored their answers, assigning one point for each of the five research-design concepts they incorporated into their design (i.e., controlling for experimenter expectations or manipulation, subject expectations, order effects, chance effects, and inclusion of a control group or condition).

Students enrolled in two additional laboratory sections of the same course served as the control group; they did not participate in the PBW exercise, but they completed the pretest and posttest questionnaires during the same weeks as the other sections. A total of 34 students (30 women and 4 men; age: $M = 23.56$, $SD = 5.79$) in all four sections of the laboratory course completed the pretest and posttest (exercise condition:

Table 1. Mean Ratings of the Quality of Research Design as a Function of Group and Time.

	Pretest		Posttest					
Variables	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*	η^2
Healing touch								
Exercise group	1.00	0.75	1.63	1.26	−2.19	18	.04	.21
Control group	0.93	0.83	0.86	0.86	0.97	13	.58	.07
Subliminal messages								
Exercise group	1.63	1.07	1.84	1.07	−1.00	18	.33	.05
Control group	1.92	1.12	1.62	1.04	1.48	12	.17	.15
Power balance wristband								
Exercise group	1.25	0.79	2.60	1.14	−5.11	19	<.001	.58
Control group	1.29	0.73	1.14	0.66	0.81	13	.44	.05

Note. All *p* values reflect two-tailed tests. The *df* values differ slightly across variables where a student did not complete 1 or 2 of the 3 items on the questionnaire.

$n = 20$ and control condition: $n = 14$).[4] Interrater agreement for the main dependent measure was high; raters agreed on 195 (96%) of the 204 coded responses (disagreements were discussed to consensus).

Results

Students responded positively to the exercise. They rated it as informative ($M = 4.24$, $SD = 0.58$) and interesting ($M = 4.33$, $SD = 0.57$), indicated it helped them understand how to design a scientific test of a pseudoscientific claim ($M = 4.33$, $SD = 0.65$), and recommended using the exercise in future research courses ($M = 4.26$, $SD = 0.73$). Seven of the 42 students wrote comments including the following: ‘‘really interesting,’’ ‘‘real life application is helpful,’’ ‘‘it was helpful for us to have a group discussion about our ideas for an experimental design,’’ and ‘‘enjoyed this exercise; I had heard about the (PBW) and wondered how to test the validity.’’

Our main interest was in examining whether the quality of students’ research designs improved more (from pretest to posttest) in the exercise group than in the control group (i.e., an interaction). A 2 (time) × 2 (group) mixed-design analysis of variancd revealed that the interaction was significant for the PBW example, $F(1, 32) = 18.20$, $p < .001$, $\eta^2 = .36$. The interaction was marginally significant for the Healing Touch example, $F(1, 31) = 3.94$, $p = .056$, $\eta^2 = .11$. Finally, the interaction was not significant for the subliminal messages example, $F(1, 30) = 2.84$, $p = .10$, $\eta^2 = .09$. To further explore the nature of the interactions, a series of planned comparisons were conducted to examine the pretest–posttest changes in each group. As shown in Table 1, the exercise significantly improved the quality of students’ research designs for the PBW and Healing Touch. However, there was no significant change in the quality of their research design for testing subliminal messages. Finally, the control group exhibited no significant changes in the quality of their tests for any of the three phenomena.

Discussion

We were encouraged by students’ positive reactions to the exercise and the effects it had on students’ ability to design scientific tests. Students’ low research-design scores on the pretest suggest that the task was a challenging one for them, even though they had nearly completed a two-course sequence in research design and statistics. The fact that a relatively brief exercise improved their ability to design such tests, and that their skills generalized beyond the specific example of the PBW (i.e., to the Healing Touch example), is encouraging for instructors who would like to incorporate pseudoscience into their research courses but do not want to spend many class periods doing so.

We used the PBW because (a) many students are familiar with this product, (b) it is possible to demonstrate its purported effects in class, (c) a controlled test of the PBW can be conducted in a short period of time (i.e., less than 10 min), and (d) designing a rigorous test of the PBW is a fairly challenging task that requires controlling for order effects, chance effects, subject expectations, and experimenter expectations (or manipulation). However, any pseudoscientific practice or product that has observable effects and can be demonstrated and tested during class could also serve as the basis for the exercise. For example, instructors could demonstrate dowsing (Lawson & Crane, 2014) or perform a psychic reading on a student (e.g., Lawson, 2003) and invite students to design tests of these practices.

One limitation to our exercise might be that we focused mainly on one pseudoscientific product rather than several different pseudoscientific phenomena. However, we did invite students to design a test of the Feingold Diet. As compared to our pilot study of this PBW exercise (Lawson & Gialopsos, 2015), our results suggest that including additional examples helps students generalize their research-design skills beyond the PBW to other pseudoscientific phenomena. An idea for future research might be to compare our approach with a different approach in which students simply read brief descriptions of pseudoscientific practices (i.e., rather than demonstrating them in class) and design scientific tests of them. Although the latter approach might not be as engaging as in-class demonstrations, it might allow for coverage of a wider variety of pseudoscientific practices and improve students’ ability to generalize their research-design skills to other pseudoscientific phenomena.

In conclusion, this exercise is a fun and effective way to enhance students’ research-design skills. Given the frequency with which students encounter pseudoscientific phenomena in their daily lives, and the problems that the field of psychology has had with pseudoscientific practices (e.g., Lilienfeld, 1998), we believe it is important to incorporate pseudoscientific topics throughout the psychology curriculum. Incorporating these topics into research-design courses has the potential to not only improve students’ critical thinking about pseudoscience but also improve their research-design skills.

Appendix A

Feingold Diet Example

Mary, the mother of Alicia (who is 7 years old), decided to put her daughter on the Feingold Diet (i.e., removing artificial colors, flavors, and preservatives) to decrease Alicia's hyperactivity. Mary noticed that Alicia was very hyperactive on Monday, after Alicia consumed her favorite brand-name applesauce and fruit juice. Mary told Alicia that she was going to make homemade, all-natural applesauce and fruit juice for her in order to decrease Alicia's hyperactivity. Mary made applesauce and fruit juice that looked and tasted like the brand-name products Alicia was used to consuming. After feeding Alicia the new diet on Tuesday, Mary noticed that Alicia was much less hyperactive. Mary was very pleased that the Feingold Diet improved Alicia's behavior. Imagine that Mary had consulted with you prior to feeding the Feingold Diet to Alicia. Explain how you would design a scientific test to determine whether this diet actually improves Alicia's hyperactivity.

Appendix B

Example Descriptions of Pseudoscientific Phenomena

1. Claire, a Healing Touch practitioner, is working with her client, Paul, to improve the pain he experiences from migraine headaches. During his first visit with Claire, Paul explains that he is experiencing a high level of pain from a migraine. Claire begins using Healing Touch therapy. She moves her hands a few inches above various parts of Paul's body to harmonize or balance the invisible energy field that surrounds his body, with the goal of decreasing Paul's pain. After receiving the Healing Touch therapy, Paul reports that his headache pain is gone. Claire is pleased that this therapy worked so well for Paul.

   Question: Imagine that Claire had consulted with you prior to using the Healing Touch therapy with Paul. Explain how you would design a scientific test to determine whether the therapy actually improves Paul's pain. Provide enough detail to allow a researcher to actually conduct your test.

2. Paula owns a florist shop and wants to improve the creativity of one of her workers, Sharon, by using audio tracks that contain subliminal messages. Subliminal messages are messages that people cannot hear (at least not consciously), because the volume of the messages is so faint compared to the louder volume of the music or audio track. The audio track selected by Paula sounds like ocean waves crashing on the shore. Although the recording includes a voice saying "You are a creative person" and "You can choose to use your creativity at any time," nobody who listens to the music would be able to tell that those verbal messages are in the recording. Paula often plays calming audio tracks in her shop, such as tracks of the sounds of ocean waves, but she has never tried playing audio tracks that include subliminal messages. On one particular Wednesday morning, Paula noticed that Sharon was not being very creative with the flower arrangements she was making. So Paula informed Sharon that she was going to play an audio track throughout the afternoon that had subliminal messages designed to improve people's creativity. Paula noticed a dramatic improvement in Sharon's creativity during the afternoon; Sharon was digging in the scrap boxes and was using scrap material to produce very unusual and creative floral arrangements. Paula was very pleased that the subliminal messages in the audio track worked so well to improve Sharon's creativity.

   Question: Imagine that Paula had consulted with you prior to using this audio track. Explain how you would design a scientific test to determine whether the audio track actually improves Sharon's creativity. Provide enough detail to allow a researcher to actually conduct your test.

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Notes

1. Although the student was unaware of any manipulation by the instructor, the balance and strength tests were more successful with the power balance wristband (PBW) than without the PBW because the instructor pushed down and slightly away from the student's body in the absence of the PBW (causing the student to lose balance or strength) and slightly toward the student's body in the presence of the PBW (causing the student to remain in place). The flexibility test was successful because of an order effect (i.e., the stretching that occurred during the first flexibility test caused the student to be more flexible during the second attempt, when the student wore the PBW).
2. For readers who are unable to access the video, a description of the three tests follows: For the balance test, the instructor asked the student to raise and extend both arms from his or her sides so they were even with the shoulders. She asked the student to raise his or her left knee upward so that the student's foot was off the floor. The instructor asked the student to find his or her balance, then she pushed her hand downward on the student's stiff left arm, at the elbow, until the student tipped over to the left. The instructor then placed the PBW on the student's wrist and repeated the balance test and the student did not tip over.
   For the strength test, the instructor removed the wristband and asked the student to stand with his or her legs together and arms by his or her side. She pushed her fist downward into the student's left palm and instructed the student to try to stay upright, but the

student soon lost his or her footing and moved to the left. The instructor placed the wristband back on the student's wrist and repeated the strength test. The student did not move, even though the instructor was exerting much more force to move the student. For the flexibility test, the instructor removed the wristband and asked the student to hold his or her right arm straight out in front of him or her. She asked the student to keep his or her feet planted and rotate his or her upper body as far as possible. The instructor noted how far the student's arm moved. After the student was back into his or her original position, the instructor put the PBW on the student's wrist and repeated the flexibility test. The student rotated and moved his or her arm farther the second time.

3. We added this additional problem to our exercise after a pilot study of the exercise (Lawson & Gialopsos, 2015) showed that, although the exercise improved students' research-design skills for tests of the PBW, students did not generalize those skills to other pseudoscientific phenomena. In class periods before and after the exercise, students enrolled in either a psychology or criminology research course ($n = 23$) read anecdotal evidence supporting each of three pseudoscientific phenomenon (i.e., a pendulum test of chakras, dowsing, and the PBW) and explained how they would design a scientific test of each phenomenon. The results showed that students significantly improved their ability to design a scientific test of the PBW but not of dowsing or the pendulum.
4. An additional 27 students in the exercise condition and 6 students in the control condition were dropped from further analysis due to incomplete data. These students were either not present at the pretest or posttest ($n = 22$) or did not respond to a majority of the questions on at least one of the questionnaires ($n = 11$). Although the reasons for student absences are unknown, the lab instructors reported that student absences are not unusual near the end of the semester. Because one of the sections in the experimental group met closer to the end of the week, this might partly explain the greater number of absences in that group compared to the control group.

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