times students must be asked to look again to see the reason the treatment produced no significant difference.

Usually each semester complaints surface about some members not contributing equally to the group. It is necessary to monitor group activity closely during the semester and determine, by the quality of the lab reports, which members have not been performing adequately. This has continued to occur in about 10% of the groups over the past 5 years. It is difficult to prevent.

Another problem is synchronizing lecture material with its use in lab. Sometimes due to the timing of lecture, the background information that they need to design a thoughtful, effective experiment has not been covered in lecture by the time the lab planning session arrives. Alleviation of this problem can be accomplish by giving specific background information on the suggested topics in the beginning of the lab planning sessions. It is best if at least 3 lectures on the physiological topic are given before the students plan the lab on that topic.

A challenging aspect of this type of lab is suggesting new twists or variables in an experimental design. This takes imagination by the instructor, but including an unknown in the design makes the experiment more challenging and fun. For example, one of the “low energy” groups might design an experiment to test the hypothesis that “when we run uphill, our heart rate will increase”. Some variables that can be included in testing this hypothesis are utilizing people of different ages, genders, heights, leg lengths, leg diameters, before and after drinking a 16 ounce can of Mountain Dew, before and after a cigarette, or on a 75°F afternoon vs. a 25°F afternoon. Including some unknown variable, whether or not students can find specific references to it, makes it more of a challenge, and introduces them to aspects of physiology that might not have occurred to them.

CONCLUSIONS

Student designed labs at Loras College have immersed the students in the scientific method to a greater degree than any other type of lab environment in which the author has participated or discussed with other biology instructors. The teamwork, critical thinking, problem solving, data interpretation, and hypothesis-posing give the students the chance to think for themselves and use the physiological concepts in an applied context. It does increase student learning by increasing student ownership of not only the information but the process of scientific investigation. A discussion of any aspect of the lab planning sequence mentioned above or answers to any questions can be obtained by contacting the author at 563-588-7767 or tdavis@loras.edu

REFERENCES