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Creating Outcomes Through Experiential Education: The Challenge of Confounding Variables

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There is an increasing interest in the field of experiential education to move beyond simply documenting the value of experiential education programs and, instead, develop more evidence-based models for experiential education practice (cf., Gass, 2005; Henderson, 2004). Due in part to the diversity of experiential education programs, participants, goals, designs, and specific program experiences, there exists a broad constellation of variables that can impact the results of studies using an evidence-based approach. While many of these variables are accounted for through effective research designs, others are largely uncontrollable, yet remain influential. These uncontrollable variables can often distort or confound the results from research and evaluation efforts. This paper categorizes some of the most common confounding variables into three temporally based categories: Precursor, Concomitant, and Postexperience. Following this, suggestions for researchers and evaluators in addressing these variables are provided.

Keywords: Evidence-Based Practice, Outdoor Education Outcomes, Research, Evaluation

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A growing body of research literature suggests that experiential education activities and experiences have the potential to be effective at producing measurable and desirable outcomes (Baldwin, Persing, & Magnuson, 2004; Hattie, Marsh, Neill, & Richards, 1997). Despite the evidence that experiential education can be efficacious in producing desirable outcomes, there is increasing interest and effort regarding the development of evidence-based models for experiential education practice (cf., Gass, 2005; Henderson, 2004). Evidence-based practices are primarily concerned with helping practitioners make decisions about *how* to practice that are based on data rather than on anecdotes, opinions, or precedent. The movement to more evidence-based practices in experiential education aspires to maximize effective practice by enhancing best practices and eliminating marginally effective or ineffective efforts.

While providing convincing evidence regarding the process and outcomes of effective experiential education programs is a necessary goal, it is often a challenging undertaking given the diversity of variables such as participants, program designs, and individual program experiences. While many of these variables can be accounted for through adequate research designs, others remain largely uncontrollable, but still influential. These variables can confound the findings of a research or evaluation effort; hence the term "confounding variables." Each of these potentially confounding variables can influence *what* and *how* participants learn from an experiential education program, and what they *report* they learned or experienced from that program. The purpose of this paper is to explore some of the most common confounding variables in experiential education, and to offer suggestions for addressing these variables to researchers and evaluators.

Confounding Variables

Vogt (1993) defines confounding variables as variables that obscure the effects of another variable. For the most part, confounding variables are confounding because they serve to confuse and obfuscate both the findings from the data, as well as the conclusions drawn from the study. In other words, it becomes unclear whether the actual *treatment* caused the effect, or the presence of the confounding variable influenced the outcome. For a variable to be confounding it must (a) be associated with the independent variable of interest, and (b) be directly associated with the outcome or dependent variable. For example, consider one instructor involving his

students in a program lasting two weeks while another instructor involves her students in a program that lasts three days. Utilizing an outcome-based evaluation scheme comparing how much each group learned might be misleading because the two independent variables (length of program, and instructor effectiveness) would be confounded. One of these variables could obscure the effect of the other, and yet both may be directly related to the outcome variable (in this case, learning).

Numerous variables can confound or confuse the findings from a research study. Validity issues such as whether the treatment or experience actually created the findings often become more obscure when faced with the presence of one or more of these confounding variables. Understanding what these variables are, and how they influence the findings, can be helpful in dealing with this issue and finding possible solutions.

Confounding variables in experiential education include a wide range of traditional issues such as selection bias, maturation, intervening effects, changes in how the measurement scheme is conducted and mortality (i.e., dropouts from the study) (Trochim & Donnelly, 2007). In the experiential education setting, confounding variables tend to be difficult to control or account for because they often are outside the ability of any programmer to manipulate. For example, weather can profoundly alter the results of a study, but researchers have yet to develop the ability to significantly impact the weather. On the other hand, the temporal aspect of when these confounding variables actually exert their influence on the outcomes of a program, or research effort, can be somewhat predetermined. For example, pre-experience anxiety that is sometimes felt by participants typically occurs before the experience starts, while postexperience euphoria is usually seen upon completion of the experiential education course or program. Thus, for the purpose of this paper, confounding variables were categorized into three main areas: *precursors, concomitant,* and *postexperience.* Table 1 provides a list of selected precursor, concomitant, and postexperience confounding variables that can typically occur in an experiential education setting. A more detailed description of these potential confounding variables is provided in the next section.

Precursor Variables

Precursor confounding variables typically exert their influence *prior* to the beginning of an experiential education experience. These variables tend to be antecedent in that they often represent variables that an individual "brings into" the experience. Examples of variables that typically fall into this category include specific demographics such as age, ethnicity, gender, and personality. Other precursor variables that can confound the results of a study but are less generally recognized include the following:

Table 1
Common Confounding Variables in Experiential Education Research and Evaluation

Precursor (*Before the Experience*)	Concomitant (*During the Experience*)	Postexperience (*After the Experience*)
Prior knowledge and experience	Course specifics	Social desirability
Demographics	Group characteristics	Postexperience euphoria
Pre-experience anxiety	Situational impacts	Postexperience adjustment
Pre-experience motivations and expectations	Frontloading for evaluation	Response shift bias
Self-selection into a specific program/course or experience		

- *Prior knowledge and experience* can have a tremendous impact on the outcome of an experiential education experience, as participants with more or less past background and knowledge have both the ability to learn and benefit from (or not benefit from) different lessons of the experience.
- *Demographics* such as age, sex, and socio-economic status have shown to be important predictors of what participants learn (see Ewert & McAvoy, 2000; Goldenberg, Klensosky, O'Leary, & Templin, 2000).
- *Pre-experience anxiety, motivations,* and *expectations* can all influence a participant's readiness to learn, engage in, and benefit from a learning experience.
- *Self-selection into a specific program* can make comparisons between experiential education experiences problematic. While individuals inevitably have a variety of reasons for choosing to participate in one program or experience over another, these choices create groups that are often fundamentally different from one another on a number of characteristics. Thus, variance between experiential education experiences is difficult to isolate from the inherent differences between the groups or individuals.

Concomitant Variables

Concomitant variables often arise during an experiential education experience and influence the outcomes during, or immediately after, that

experience. Examples of concomitant variables include group dynamics that develop during the experience and specific events that occur during the experience. Concomitant variables include those variables and factors that typically occur as the experience progresses. For example, *course specifics* refer to the actual details and structure of the program or experience. Variables such as course length, the specific activities, and the influence of the course instructors are all examples of potential concomitant confounding variables. While it could be argued that many of these might be variables of primary interest in the study (e.g., the independent or predictor variables), other course specifics not of interest to the study must be addressed or they may invalidate the study's findings.

Similarly, *group characteristics* refer to the attributes and characteristics of the individuals who make up the group, as well as the group itself. These types of variables refer to interactions that occur between group members during the course, and serve to help create a distinct "group dynamic" or "group personality" beyond that of individuals' backgrounds and past experiences. Group characteristics include how a group interacts with the challenges and experiences presented by the course. The group's response to the selected activities and experiences can be beneficial, inconsequential, or detrimental for a particular individual or the group as a whole.

Similar to the effect of history, *situational impacts* refer to specific, non-structured, or unanticipated events that occur during an experiential education experience. Events such as accidents, evacuated students, or other mishaps can alter the planned outcomes of an experiential education program. Depending on the type of occurrence and severity of the event, the effects of situational impacts can range from minor and inconsequential, to an immediate need to end the experience. In this latter case, the impacts to the results of a study are obvious and usually deleterious to the outcomes. On the other hand, situational impacts can sometimes exert a positive and beneficial influence in the outcome of an experiential education experience.

Related to this is the concept of "treatment fidelity." That is, to what extent did the actual program or experience conform to the expectations of the researcher? If the researcher or evaluator expected the instructors to adhere to a standard curriculum or treatment modality, and that did not occur, then any findings may be biased by the influence of the instructors' idiosyncratic behaviors rather than to the effects of the treatment or curriculum. The goal of treatment fidelity is to minimize errors between what the researcher intends and what is actually delivered in order to provide convincing evidence regarding the efficacy of a particular treatment or intervention (Spillane et al., 2007). This minimization of errors in interpreting research outcomes remains a critically important goal in most social and behavioral research efforts (Borrelli et al., 2005).

Frontloading for evaluation refers to the often subtle but important process by which instructors and/or program participants either consciously or unconsciously influence the study results because of the evaluation process. Instructors may alter the experience to match the study goals or hoped-for findings; this would be similar to an experimental bias. For example, if a pair of instructors knew that a particular group of participants they were leading were being evaluated on levels of self-esteem, they might reconsider how they planned and conducted the course. They may place a greater emphasis on conducting briefings on self-esteem issues than would normally be the case. Moreover, they may design activities and experiences that focus on self-esteem issues. Such actions could alter the meanings and outcomes students might ascribe to these experiences. In addition, students might, through a pretest, be predisposed to learning certain course outcomes; this is generally referred to as a pretest by treatment interaction (cf., Campbell & Stanley, 1963). While neither of these approaches is necessarily detrimental to the students, the findings from the study might be highly dependent upon the specific evaluation efforts rather than on the program itself.

Along with concomitant variables that occur during a course are those variables whose influence is primarily felt *after* the experience is completed. A sampling of Postexperience Variables is discussed in the following section.

Postexperience Variables

Postexperience confounding variables are evident *following* the completion of an experiential education experience. As data collection (e.g., testing or interviewing of participants) commonly occurs immediately after a course or program, postcourse variables can be particularly problematic in influencing the outcomes of a research or evaluation effort. Examples of postexperience variables are (a) social desirability, (b) postexperience euphoria, (c) postexperience adjustment, and (d) response shift bias.

Social Desirability, or the tendency of individuals to respond to a questionnaire or interview in a way that is deemed more "desirable" or "acceptable," regardless of their true feelings (Ewert & Galloway, 2006; Paulhus, 1991), is a potential confounding variable present in any study using a self-report or interview mechanism. That is, individuals are often concerned with issues of image management and self-deception positivity (i.e., wishing to appear positive), and have a potential tendency to answer questions accordingly. For example, if an individual wants to be seen as being in control of any situation, he or she might address questions about levels of anxiety in a manner that would project this courageous image, even if this were untrue, thus confounding any findings

regarding the efficacy of a program in actually reducing levels of anxiety (Scott & Hoffman, 2003, pp. 246–248).

Postexperience Euphoria is a mood expression that conveys a feeling of excitement, positive affect, and a sense of accomplishment following an experiential education experience (e.g., see Marsh, Richards, & Barnes, 1987). This confounding variable can obscure actual feelings about one's abilities, the course experience, or connections to other course members. Because this effect can often be short-term, an individual's true feelings about a specific experience can be hidden or remain unclear if a measurement is taken immediately following the experience.

Postcourse Adjustment, sometimes known as re-entry issues, refers to a time when an individual adjusts back to "normal" life following an experiential education program. For some, this period can be fairly routine. For others, however, this adjustment can be painful and traumatic, even to the extent that it emulates a grieving process (Allison, 2000). Similar to postexperience euphoria, postexperience adjustment confounds research findings because it presents data collected from an individual that may not reflect how that individual usually feels or reacts. The question arises: "Are we seeing the actual results from an experience, or just a manifestation of the postexperience adjustment issue?"

Response Shift Bias can occur when the testing or measurement of a self-perception variable occurs at different times, and the participant's understanding of the variable changes over this time period (cf., Sibthorp, Paisley, Gookin, & Ward, 2007). For example, if a participant is asked to rate his/her productive teamwork skills before, and again after, an experiential education program that is designed to foster teamwork through interactive activities and discussions, it is possible that the participant's understanding of productive teamwork skills will change over the duration of the program. Thus, it is not useful to compare the pre-experience perceptions with those reported after the experience, as the standard used to assess "productive teamwork skills" may have changed as a result of the experiential education event.

In another example, Hess (1975) noted that self-concept scores for a 4-day course appeared inflated when compared to those from a similar 14-day course. He concluded that the students on longer courses had more time to acquire a more realistic view of themselves, which often resulted in a reduction of self-concept during the experience. This "afterdrop" is analogous to the phenomenon seen in the treatment of hypothermia where the body core temperature suddenly drops during the rewarming phase and is another example of response shift bias.

Addressing Confounding Variables

One of the main challenges regarding confounding (or potentially confounding) variables is that they must be identified and addressed during the research design and before the data collection phase of the study. If not addressed through research design and data collection, there is virtually no way to account for the confounding variable during data analysis. There are four main ways an investigator might choose to address confounding variables commonly found in experiential education research: (a) sampling, (b) assignment, (c), statistical analysis, and/or (d) timing. Table 2 identifies examples of potential methods for controlling or accounting for the confounding variables previously described.

If a certain variable is thought to influence the main dependent variable of interest, a researcher might be able to narrow the sample down to eliminate the influences of this variable. For example, if age was thought to be a confounding variable, then the sample could be constrained to include only a narrow range of participants.

While somewhat uncommon in field-based experiential education research and evaluation efforts, intentional, systematic, or random assignment may be used to control for the influence of confounding variables. For example, if pre-experience anxiety is a potential confounding variable, randomly assigning participants into groups should assure that the influence of anxiety will equally impact both groups. However, greater variance in pre-experience anxiety will still introduce error into both groups and will make detecting differences between them more difficult.

Statistically controlling for confounding variables is one way to address their influence in a study. The main challenge to this approach is measuring/operationalizing the variables in a meaningful yet parsimonious way. For example, "How do you measure a person's precourse experience?" However, if the variable is easily measured (e.g., participant's age), then statistically controlling for the influence of a variable is more appropriate. Group characteristics and potential group level confounds (e.g., group coherence) can be addressed statistically. Many of these group level influences are appropriately addressed through multilevel modeling.[1]

If the timing of the data collection results is a potentially confounding variable, then the researcher should consider collecting data at another time. However, if all participants are equally affected by some universal time (e.g., postexperience), then the influence and impact on the outcome variable will be universal and may not directly influence the ability to determine the relationship between the outcome variable and other variables of interest. The time, however, would need to be controlled so that all participants provided data at equivalent times (e.g., all at postexperience, or all one month later). Evaluation studies primarily concerned with

Table 2
Potential Ways to Control for Confounding Variables Related to Experiential Education

Potential Confounding Variable	Example for Controlling Confounding Variables Common to Experiential Education Studies
PRECURSOR	
Prior knowledge and experience	A researcher might decide to only include participants who had never before participated on a challenge course in a study of challenge course outcomes.
Demographics	A researcher might ask respondents to report their age and biological sex to statistically control for the influence of these variables in a correlational study regarding relationships between wilderness course factors and reported outcomes.
Pre-experience anxiety	A researcher might have participants complete a pretest questionnaire before arriving at the program location to reduce the influence of pre-experience anxiety on the pretest scores.
Pre-experience motivations and expectations	A researcher might randomly assign participants to treatment and control groups to balance out the influence of pre-experience motivations and expectations in his/her study of instructional strategies during a service learning experience.
Self-selection into a specific program	A researcher might randomly assign participants to treatment and control groups to balance out the influence of self-selection into the program in her study of the influence of wilderness-based and campus-based freshmen orientation programs.
CONCOMITANT	
Course specifics	A researcher might sample only one-day challenge courses for adolescents run by a single instructor team to examine the influence of a specific sequence of activities on outcomes.
Group characteristics	A researcher might collect group level data and statistically analyze the data using the group as the unit of analysis to account for the influence of specific group characteristics (e.g., group cohesion or group maturity) on outcomes from challenge course participation.
Situational impacts	A researcher might measure some of the situational impacts hypothesized to be related to course outcomes (for example, number of evacuations, number of students on behavioral contracts) in order to statistically control for these variables in a study of wilderness program outcomes.

Table 2 (continued)

Potential Confounding Variable	Example for Controlling Confounding Variables Common to Experiential Education Studies
Frontloading for evaluation	A researcher might randomly assign groups on an environmental education field-trip to place-based and traditional educational strategies. If this is done without a pretest and without education or knowledge of the specific assessment, the possibility of frontloading for evaluation is removed.
POSTEXPERIENCE	
Social desirability	A researcher might decide to imbed a measure of social desirability into his/her study on attitude toward the environment to determine if socially desirable responding is a problem and to statistically control for it.
Postcourse euphoria and adjustment	A researcher might decide to send a questionnaire to wilderness program participants several weeks after program completion to see if perceptions of the course have changed over time.
Response shift bias	A researcher might ask participants in a day of team-building activities about their teamwork skills only at program completion (not both before and after the program) to ensure that the reported influence of the program is measured on a single internal metric.

documenting program efficacy (where the program itself is the independent variable of interest), might want to decide if postcourse perceptions or later perceptions of learning are more representative of program efficacy.

Conclusions

As researchers and evaluators of experiential education programs seek to document and establish evidence-based programs and practices, attending to the most likely confounding variables during the project design phase is critical. Confounds unattended to during the initial research design, and before data collection, are often impossible to address during the data analysis stage.

In addition to confounding variables, other variables can also cloud straightforward interpretations and relationships. Mediating and moderating variables can influence how and when an independent variable is related to, or influences, an outcome variable. In an earlier example, we showed how different instructors might confound findings related to course length. However, it is also possible that the role of an instructor (or

his/her qualities) might be moderated by course length. For example, maybe certain instructor qualities are more important (i.e., more valuable to learning outcomes) on longer courses than they are on shorter courses. Thus, while each of these variables (course length and instructor) might simply confound interpretation, they might be interrelated in such a way that is important to further exploration and understanding. For more information on the roles of mediating and moderating variables in research, see Baron and Kenny (1986).

While there are a substantial number of potentially confounding variables, many are consistent with the traditional threats to internal validity (e.g., selection bias, maturation, intervening effects, changes in measurement and mortality) (Trochim & Donnelly, 2007). The confounding variables described in this paper were selected because they tend to be present in many experiential education research settings. However, not all programs face all of these challenges nor would researchers want to address all of them in a similar fashion. For example, programs where participants are court referred do not face self-selection issues, or programs that evaluate all programs in the same manner have less challenges with frontloading for evaluation. Finally, the examples presented in this paper are for illustrative purposes only, and programs and practitioners may choose alternate approaches to address the confounding variables highlighted in this paper.

One of the major challenges confronting experiential education researchers is accounting for multiple confounding variables while being simultaneously and logistically limited in how they might control for these influences. For example, random assignment is frequently impossible or ethically undesirable during field-based experiential education research, and statistical controls are only viable when appropriate measures are available. While it would be valuable to design and conduct a study with ideal assignment selection, statistical controls, and timing, field-based researchers are often forced to make choices between what is ideal and what is feasible given the resources available to conduct the study.

Also, some of the efforts to control for confounding variables can, in themselves, lead to additional problems. For example, a researcher might decide to have participants complete a pretest before arriving at the start of the experiential education courses to investigate the presence of precourse anxiety. This added visibility might actually serve to heighten the level of precourse anxiety by calling attention to the phenomenon, which adds potential bias. In addition, the participants who volunteer to complete the precourse measure will likely be self-selected and smaller in number than the actual number of program participants. This reduces both the statistical power and representativeness of the sample. Thus, such

trade-offs should be carefully considered when choosing a solution as a researcher may simply be replacing one threat to validity with another.

Despite these challenges, we believe that researchers and evaluators should make informed decisions about which potential confounding variables to address and which ones to ignore, prior to undertaking a study. It has been this paper's intent to provide some points to consider, and some ideas that may improve experiential education research and evaluation efforts.

While most of the confounding variables described can be addressed through one or more of the main strategies discussed in this paper (i.e., sampling, assignment, statistics, timing, etc.), several may also be addressed through more specific techniques. For example, anonymity of responses is one of the more effective ways to address social desirability response bias, and a retrospective pretest or eliminating self-perception measures can be used to address response shift bias in certain situations (Sibthorp et al., 2007).

In conclusion, this paper described some of the more salient confounding variables often intruding upon a research or evaluation study conducted in experiential education. Accompanying this description was a discussion regarding possible remedies or ways to ameliorate the effects of these confounding variables. Understanding both the presence and importance of these, and similar types of variables that serve to confound or obscure the conclusions drawn from a particular study, is of paramount importance as the outdoor education field continues to draw on research and evaluation to inform evidence-based practice. Establishing practices based on evidence rather than on precedent or opinion can help practitioners to optimally design and implement experiences that facilitate positive participant outcomes.

Footnote

[1] Readers interested in multilevel modeling in experiential education are referred to Russell and Sibthorp (2004).

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