

Quantitative Theoretical and Conceptual Framework Use in Agricultural Education Research

Tracy Kitchel¹ and Anna L. Ball²

Abstract

The purpose of this philosophical paper was to articulate the disciplinary tenets for consideration when using theory in agricultural education quantitative research. The paper clarified terminology around the concept of theory in social sciences and introduced inaccuracies of theory use in agricultural education quantitative research. Finally, some specific theory uses were outlined. This philosophical paper purported that theory in quantitative research in agricultural education should be used to: 1. help develop or guide a program, through which aspects of the program itself are researched; 2. define or prescribe how a variable is measured; 3. test middle-range or substantive theories; and 4. articulate and provide rationale behind the relationships between or among variables. A clear delineation for theory use in quantitative research potentially serves the profession to focus more clearly on investigating quality, in-depth, research problems communicable to broader contexts.

Keywords: theory use; theoretical frameworks; conceptual frameworks; quantitative research

While a teaching-based discipline in origin, agricultural education has placed an emphasis in developing quality research. In the past five years alone, the leaders in agricultural education revised a National Research Agenda, organized two professional development sessions at national meetings geared toward improving quality in research manuscripts and research reviews, and engaged in a national dialogue regarding the role of abstracts and research ethics in the discipline. A scan of related research revealed that, historically, research quality, research focus, and the nature of research in agricultural education has been published in the *Journal of Agricultural Education* and related conference proceedings approximately every ten years.

The literature about research in agricultural education emerged over thirty years ago, setting precedence for a sustained focus on research methodology and topics issues. In a ten-year span between the mid 1980's to mid- 1990's, the literature on agricultural education research focused on syntheses of research (Lee, 1985), priorities for directing a research program (Warmbrod, 1986), how to direct publication (Crunkilton, 1988), obstacles to research (Buriak & Shinn, 1989), alternative types of research (Wardlow, 1989), and priorities and directions for future research (Buriak & Shinn, 1993). The research on agricultural education research in the late 1990's through early 2000's focused on reviewing prolific authors from previous decades (Radhakrishna & Jackson, 1995), developing a research agenda in agricultural education (Williams, 1997), appropriate types of analyses (Miller, 1998), topics of research inquiry (Radhakrishna & Xu, 1997), and the use of conceptual and theoretical frameworks in research (Dyer, Haase-Wittler, & Washburn, 2003). The 1980's and 1990's can be summarized as 20 years of research on how to and what to publish in agricultural education.

As agricultural education conducted more research as a discipline, the research on research consequently evolved to document esteemed researchers as well as the broader disciplinary research base. The publication trajectory of individual research authors, themes and

¹ Tracy Kitchel is an Associate Professor in the Department of Agricultural Education and Leadership at the University of Missouri, 126 Gentry Hall, Columbia, MO 65211, KitchelTJ@missouri.edu.

² Anna L. Ball is an Associate Professor in the Department of Agricultural Education and Leadership at the University of Missouri, 127 Gentry Hall, Columbia, MO 65211, BallAn@missouri.edu.

methodologies in the *Journal of Agricultural Education* was documented (Edgar, Edgar, Briers, & Rutherford, 2008), and academic departments in agricultural education were ranked based, in part upon the distinguishing characteristics of rigor and research productivity (Birkenholz & Simonsen, 2009). The National Research Agenda for the American Association for Agricultural Education (AAAE) was developed in 2007 (Osborne, 2007) and revised in 2011 to outline research priority areas (Doerfert, 2011). Finally, a manuscript in the *Journal of Agricultural Education* developed tenets for enhancing the quality of manuscripts published in the journal (Roberts, Barrick, Dooley, Kelsey, Raven, & Wingenbach, 2011). Through studies on research in agricultural education, it is clear the profession places concern on research topics, methodologies, and quality. Interestingly, over the trajectory on the research on research, the same issues of quality, topics, and methodologies continue to be revisited. Clarifying theory use, which helps shape how a study is framed and developed, could help the profession address these issues.

Researchers in agricultural education have used and misused theory in a variety of ways (Langley, Thieman, Martin, Kovar, & Kitchel, 2011), despite a clear emphasis on professional development for and research publications about research in the profession. Generally speaking, faculty have diminished research capacity in regard to time and fiscal resources, and focus a great deal of time in teaching, outreach, and service-related activities. In addition to time constraints, agricultural education comprises a very broad disciplinary research base, which could be viewed as a lack of focus. Agricultural education, as a discipline of approximately 200 members, (American Association for Agricultural Education, 2012) comprising agricultural communications, Extension, leadership, and teacher education across the six broad research priority areas of: public and policy-maker understanding of agriculture and natural resources, professional and scientific workforce for the 21st century, new technologies, practices, products and adoption decisions, meaningful engaged learning, efficient and effective agricultural education programs, and vibrant resilient communities (Doerfert, 2011).

Other, much larger social sciences-related disciplines might research the equivalent of one of those research areas with many more researchers who have much higher individual research appointments. In addition to breadth of topics, research in agricultural education has diversified in methodologies. Ten years ago, primarily descriptive-correlational designs were utilized in research published in the *Journal of Agricultural Education* (Dyer, Haase-Wittler, & Washburn, 2003), while currently, qualitative research has become a much larger focus in journal publications (Roberts et al, 2011). Thus, potential time constraints, a very broad topical scope, and a broad methodological base create challenges for new faculty and graduate students attempting to negotiate quality research in agricultural education. A solid understanding of theory use should help faculty and graduate students to focus and, therefore, be more efficient about their scholarship. Now that the importance of such an philosophical investigation has been established, it is important to situate theory to fully develop an architecture for its use.

Theory Situated

Once a researcher has developed a sound problem, the next step in appropriately situating theory within research is to consider the paradigm or worldview for the research inquiry. While a number of paradigms or worldviews inform a variety of research in the social sciences, for sake of clarity and brevity in this philosophical paper, we argue the majority of quantitative research in agricultural education has been approached through a post-positivist epistemological lens. Post-positivist worldviews guide research that is logical, reductionist in nature, deductive in approach, systematic, and determined by *a priori* theories (Creswell, 2009). It should be noted this study did not address qualitative theory use, as qualitative research is an entirely different paradigm and requires a different approach. Once theories are properly situated in a paradigm or worldview, the specific approach to inquiry can then be considered.

Typical approaches to post-positivist quantitative inquiry in agricultural education include *basic or pure*, *applied*, and *action* research (Dyer, Haase-Wittler, & Washburn, 2003). Generally speaking, the aim of basic or pure research is to develop knowledge for the sake of

knowledge, without a commercial, practical, or problem-based outcome as the focus (Biglan, 1973a). In contrast, the aim of applied research is to solve practical problems or improve humankind. As a subset of applied research, action research is a process, as well as a mode of inquiry. Action research serves to improve practice and is conducted by practitioners in very specific contexts (Stringer, 1999).

In addition to the basic or pure and applied spectrum for inquiry, Biglan (1973b) further identified a hard-soft dimension to a discipline. *Hard disciplines* tend to have a singular paradigm, whereas *soft disciplines* are multifaceted. “Fields that have a single paradigm will be characterized by greater consensus about content and method than will fields lacking a paradigm” (p. 202). The field of education has been identified as applied-soft by Biglan (1973b). Thus, education embraces multiple notions of the nature and origins of knowledge, and utilizes inquiry to expand knowledge for a practical or human use. As a sub-discipline of education, agricultural education is more deeply entrenched in the applied realm of inquiry. Agricultural education, by inquiry, is an applied discipline of a soft-applied discipline. Thus, research in agricultural education rarely, if ever engages in basic or pure research. Once the research paradigm, approach to inquiry, and disciplinary focus are properly delineated, theory then can “provide the basis for conducting a study” (Roberts, et. al., 2011, p. 2).

The Problem

Theory is central to educational research (Thomas, 1997). Theory guides inquiry and interpretation and affords academic rigor to scholarly work. Research void of theory, or *atheoretical research*, while not uncommon in social sciences, is often seen as problematic for the advancement of a discipline (Shoemaker, Tankard, & Lasorsa, 2004). Agricultural education needs to clarify use of theory because of the broad scope of research topics and methodologies, and limited research capacity and resources of individual faculty members. A clear delineation for and proper application of theory use in agricultural education would allow the profession to focus more on addressing the broad problems outlined by the National Research Agenda, and less on professional development around research. Additionally, a clear delineated approach for theory use is needed to rectify the ambivalence surrounding theory use, misuse, and associated terminology in the agricultural education literature. A stronger architecture for theory use in agricultural education serves to further connect the body of knowledge within the discipline and to broader fields.

Purpose and Objectives

The purpose of this philosophical paper was to articulate the disciplinary tenets for consideration when using theory in quantitative research in agricultural education. To accomplish this purpose, several objectives were constructed:

1. Clarify the definition of theory in quantitative research in agricultural education;
2. Articulate proper theory use, as well as various inaccuracies of theory use in agricultural education; and
3. Articulate a framework for theory use in agricultural education quantitative research.

Methods and Procedures

The design of this study was philosophical in nature. A clear philosophy serves to develop canons for what is “real, true, and of value” for a profession. Philosophical approaches to research are generally void of traditional research methods, but rather serve to argue a specific aspect of a disciplinary knowledge base (Burbles & Warnick, 2006). Sound philosophical methods include rigor in research review, well-articulated focus, and acknowledgement of

multiple perspectives (Burbles & Warnick, 2006). The researchers approached this philosophical paper through a constructivist epistemological lens (Guba & Lincoln, 2005), viewing knowledge as a product of collective human consciousness, with the goal of creating a narrative to expand the professional discourse regarding this topic. To ensure rigor, the researchers focused the philosophical lens and subsequent review of literature toward the scope of theory use in educational and agricultural education research from 1985 to present. Frequent peer debrief was utilized to ensure credibility and trustworthiness of the philosophical reflection.

Definition of Theory

The first objective for this philosophical paper was to clarify the definition of theory in agricultural education quantitative research and adopt a common terminology. Barriers to proper theory use in education and other social sciences research include: theory has taken many different meanings, there are different kinds of theories used, and there is confusion among the terms for identifying and situating theories within the literature review of a manuscript. Proper theory use begins with clarity about what theory is, a delineation of appropriate types of theory in agricultural education research, and clarity of terminology for theory.

Theory Defined

While the roles of theory have been disputed in educational research (Thomas, 1997), seminal quantitative research methods texts appear to delineate theory by fairly straightforward definitions. In educational research methods texts, Creswell (2009) and Ary, Jacobs and Razavieh (2002) used Kerlinger's (1979; 1986; as cited by Ary, et al., 2002) definition of theory. Kerlinger (1986) stated that theory is "a set of interrelated constructs or concepts, definitions, and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena" (p. 9). In the field of communication, Wrench, Thomas-Maddox, Richmond and McCroskey (2008) stated, "a theory is a proposed explanation for how a set of natural phenomena will occur, capable of making predictions about the phenomena for the future, and capable of being falsified through empirical observation" (p. 13). In both definitions, theories are used to explain and predict phenomena and helps to answer the "what", "how" or "why" particular phenomena occurred.

Theory Typology

In soft-applied disciplines such as education, several different typologies of theory have been identified. Camp (2001) defined different types of theory for career and technical education as adapted from Creswell (1994) including: *grand*, *middle-range* and *substantive theories*. Grand theory was used to "explain major... phenomena and more are more common in natural sciences," middle-ranged theories "fall somewhere between the working hypothesis... and grand" and substantive theories "offer explanations... limited in scope" (p. 7). Similarly theories have also been delineated by level rather than type. Neuman (2003) described levels of theory as *micro-level* or utilized for a very specific context, *meso-level* as a link between micro and macro, and *macro-level* (larger levels or institutions and societies; tends to be very abstract) theory. Although the definitions of the two sets of terminology are not identical, there is a sense that theories can be classified based upon their size, type and scope of context.

Clarity of Terminology around Theory

Terminology around *theory*, such as *theoretical frameworks* and *conceptual frameworks* in social sciences literature reviews have also differed. Although Jaccard and Jacoby (2010) stated the role of theory in social sciences research was not disputed, Thomas (1997) argued that how theory transpires and is ultimately used is unclear. Reynolds (2007) acknowledged there are multiple iterations and intentions for the term theory. When the words framework and model were added to the discussion, theory assumes multiple meanings for various disciplinary uses. Shoemaker, Tankard and Lasorsa (2004) attempted to delineate the terminology for theory, theoretical frameworks, and models by noting the meaning behind the terms depends upon the context in which they are used.

Camp (2001) further acknowledged the lack of clarity regarding the terminology related to theory and theoretical frameworks in career and technical education. He posited that when a conceptual framework is used in a research study, it is done so in the absence of a grand theory or reputable middle-range theory. Camp continued, “if the conceptual framework begins with a supportable premise and then extends that premise through a logical path of reported research and clear reasoning to form the basis for the study, then it is in fact a substantive theory” (p. 18). Therefore, a conceptual framework can be defined as a representation of substantive theory if there is a solid rationale, which accompanies said framework. Shoemaker et al. (2004) supported this stating that while a theory could explain or predict, a model merely describes. In Figure 1, a very simplistic conceptual model illustrates a relationship between Variable A and B, but not why said relationship exists. Shoemaker et al. state, “though a model is not a theory, a model can be used to represent a theory” (p. 112) and continue that a model helps describe an object or process, but theory is needed if the author intends to “understand how the object or process works” (p. 112).



Figure 1. A conceptual framework in its simplest form

For the sake of clarity and given the number of labels and typology outlined thus far, we purport the following terms be adopted for agricultural education. First, the terms *theory* and *theoretical framework* (we argue these terms are interchangeable) are defined as a statement or complex argument explaining and/or predicting phenomena. As we synthesized previously, theory should answer the “what”, “how” and/or “why” particular phenomena occurred. Next, we acknowledge theories or theoretical frameworks differ in scope and thus differ in use. The Creswell (1994) typology of *grand*, *middle-range* and *substantive* is a clear typology for use in agricultural education as cited in our broader field of career and technical education by Camp (2001) and by our own journal (Roberts, et al., 2011). Finally, the terms *conceptual framework* or *conceptual model* (terms we argue are also interchangeable) only refer to a visual diagram or description indicating relationships between or among variables. A conceptual framework or model indicates a relationship exists, but lacks the rationale behind the relationship. Thus, a conceptual framework or model should be based directly on some type of argument or substantive theory (Camp, 2001), or as Shoemaker et al. (2004) implies, be a visual representation of a theory itself.

Theory Use and Misuse

The second objective for this philosophical paper was to articulate uses of theory as well as inaccuracies of theory use in quantitative agricultural education research. Very little literature articulates how theory could or should be used. However, to understand theory in injury prevention research, Trifiletti, et al. (2005) identified the following three uses (p. 302) for theory:

1. Guide design, program or measures;
2. Measurement of theory or constructs;
3. Tested theory

Theory use in agricultural education quantitative research was investigated in the *Journal of Agricultural Education* from 2007-2011 (Langley, et al., 2011) using the Trifiletti, et al. (2005) category model. The purpose of the study was to determine if theory use in agricultural education aligned with some published standard on theory use. The findings revealed that in the *Journal of Agricultural Education*, theory was used to measure a construct approximately 53-59% of the time, except for in 2007, where theory was used over 74% of the time to measure a construct. Further, very few if any studies used theory to guide program design. Approximately 7-23% of studies over a five year time span used theory in research to test a theory. Finally, the findings revealed an “other” use of theory category that accounted for nearly 10% of theory in 2007, almost 23% of theory use in all articles in 2011, and approximately 33-35% of theory use in articles between 2008-2010. Langely et al. noted that the “other” category tended to be use of theory to rationalize the need for the study rather than to guide a program, measure a construct or test a theory. To present, using theory to rationalize the need for a study has not surfaced in the literature and would not be considered an appropriate use of theory for a research study and thus we discourage using theory in such a way. This finding pressed the researchers to ask questions regarding the quality of theory selected and accurate uses of theory in agricultural education research.

Several inaccuracies or misconceptions of theory in quantitative research have shaped theory use in agricultural education. Use of grand theory, semantic use of theory, mismatching theory for the particular study, and selecting low quality or discounted theories are all practices to be avoided in quantitative research in agricultural education.

Using Grand Theory

One common misuse for theory in quantitative agricultural education research is the inaccurate use of grand theory. As Camp (2001) articulated, grand theories are more common in natural sciences than social sciences. Using a grand theory in a study by approach, assumes that the phenomena can be answered by a singular paradigm. As noted earlier, when single paradigm approach is followed, the discipline tends to align more with a hard versus a soft disciplinary approach (Biglan, 1973a; 1973b). As agricultural education is a soft-applied discipline, it would stand to reason that grand theory use might be problematic for quantitative research in agricultural education. Grand theory use has also been discouraged broadly in education disciplines (Thomas, 1997). The following example is used to illustrate why grand theory use may not be the best choice for a soft applied field. The example is purposely a non-social science example to emphasize the fallacy of using grand theory.

Presume a ball sits on top of a table and falls off. Taking a scientific approach, a researcher wanted to determine why the ball fell off the table. If the researcher applied a grand theory approach, she/he could easily say that gravity explains why the ball fell. On a very broad level, the laws of gravity do explain why the ball fell. However, if the researcher wanted to prevent the ball from falling again, the laws of gravity provide little substantive explanation from an applied or pragmatic viewpoint because there could be a myriad of reasons *why* the ball fell. If a more specific theory were selected to better explain the context, then the researcher could make

conclusions toward preventing the ball from falling again. If the ball fell because the air was pushing it from an adjacent vent, that would lead to further investigation related to placement of the ball or the table. If the ball fell because of an earthquake, then further investigation would ensue related stabilizing the table itself. From an applied standpoint, both examples lead to two different areas of inquiry. When applying a grand theory to research, the researcher loses opportunities to connect the findings to solve a more specific problem. In addition, the researcher potentially loses a clear direction for further research.

It should be noted the use of grand theory could be appropriate in specific ways. In some grand theories, there are more specific tenets that may be more accurately classified as middle-range theory. For example, for the grand theory of Information Processing, one of the middle-range theory tenets is memory (Santrock, 2004). If one was studying some type of rehearsal mechanism such as repetitive lecture capture use as it relates to student achievement, it would be appropriate to briefly identify the grand theory of Information Processing, but spend most of the discussion explaining the tenet of memory and, more specifically rehearsal, to help situate the research and measure the phenomenon.

Related to grand theory use, large-scale conceptual model use can also be problematic. However, if such a conceptual model is used, it should be selected and positioned properly within a study. Some large scale, models are robust and supported by a substantial body of literature, and other models attempt to explain so much, that the model is empty. As outlined in Figure 2, Dunkin and Biddle's (1974; as cited in Cruickshank, 1990) model identifies many aspects of the learning environment, but ultimately, the model explains so much that it is limited in depth to explain any one particular phenomenon with appropriate detail. When one deconstructs the model, it seems to claim that numerous teacher characteristics and student characteristics interact in the learning environment, which lead to long and short-term effects for the students. If a researcher studied two specific aspects (randomly, let us take student social class from "context variables" and attitude from learning from "product variables"), is this study supported well by the model? The authors of this paper claim it is not well supported for the same reason that gravity was an empty explanation for why the ball fell. If the authors connected the literature back to poverty literature, for example, there would have been a stronger connection of the findings to a literature base and a clearer direction for further research. In general, a model like Dunkin and Biddle (1974) would not be a sound choice for contemporary agricultural education research.

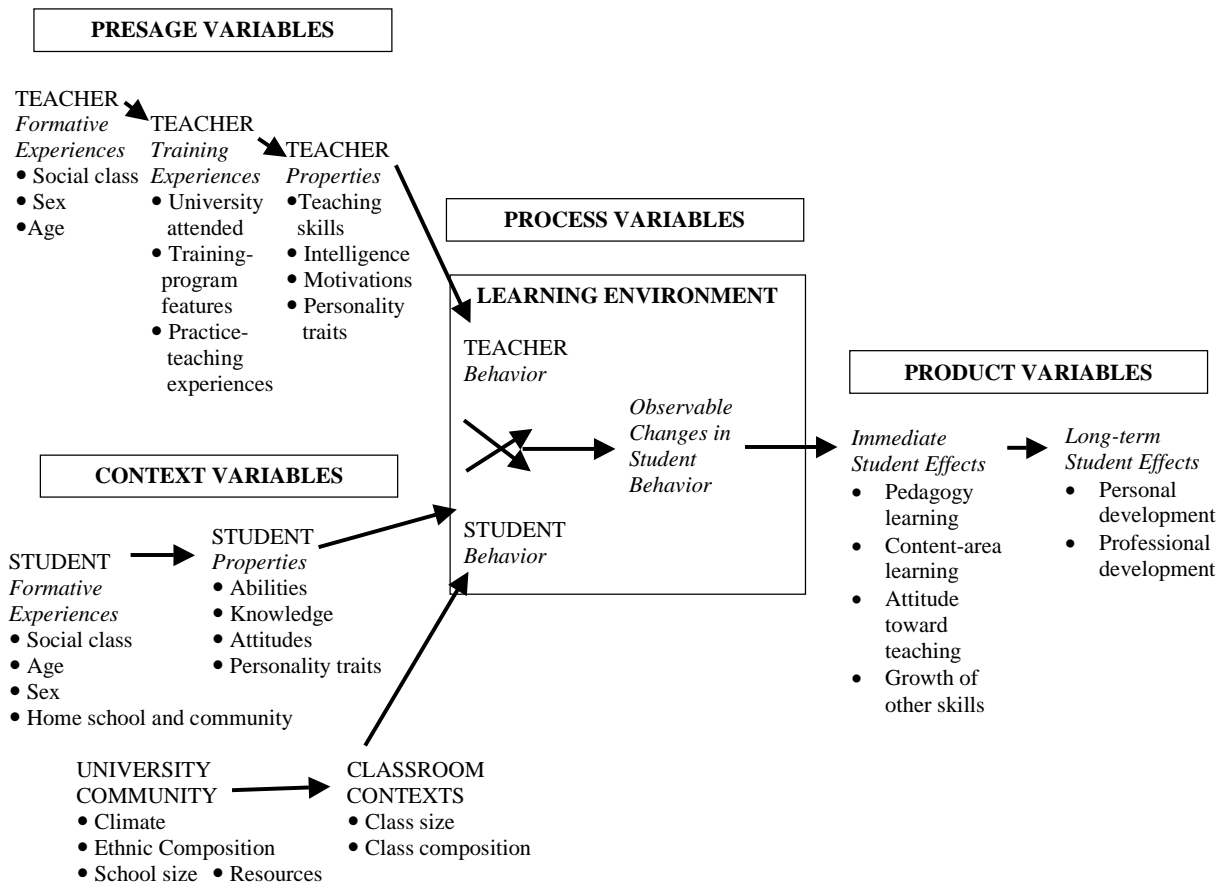


Figure 2. Dunkin and Biddle Model

Semantic Use of Theory

Another inaccurate use of theory occurs when the researcher fails to understand the depths of the theory, which translates to a mere semantic use of theory in a literature section of a paper. When a researcher engages in mere semantic use of a theory, the researcher reads a singular explanation or limited information about the theory and uses that limited wording, or those semantics, as the sole theoretical rationale for the study. Semantic use of theory, like use of grand theory, prevents the researcher from connecting the research to substantive concepts, and limits the research path for further research.

An example of semantic use of theory can be seen when inappropriately using the Reciprocal Determinism Model, which is a part of Bandura’s larger work in social cognition (Santrock, 2004). In a semantic approach to the theory, one could note the model merely involves the interactions among behavior, person/cognitive factors, and the environment. Therefore, using this model in such a way could support any study involving a person who behaves in an environment. While an over-simplified example, if a researcher fails to understand the depths of the theory in this case, he or she could inappropriately be using the model by simply associating the variables in their study to the words person, environment and/or behavior.

Mismatch of Theory to a Study

Related to semantic use of theory, another potential misuse of theory is the mismatch of theory to the study. Like semantic use, a mismatch occurs for two reasons. First, a mismatch occurs because the researcher does not understand the depths of the theory or fails to hone in on the key aspects to the theory. Secondly, the mismatch occurs because the researcher does not focus on the real research problem. For example, Kolb and Kolb (2005) delineated six propositions about experiential learning. Ultimately, the word “learning” is the first and second word to every proposition in Kolb’s theory and thus it is logical to deduce that learning is central to the theory. To that end, if a researcher wanted to investigate agriculture teachers’ perceptions of Supervised Agricultural Experience (SAE) practices’ roles in community development, one might think about using experiential learning theory. At first glance, Kolb’s theory of experiential learning may seem as the appropriate match as SAE’s are experiential in nature. We would argue that in this particular example, the use of experiential learning theory would be inappropriate because teacher perceptions, not learning outcomes, were measured in study. In this example, SAEs was the context for the study, not the central focus. When trying to negotiate the appropriateness of the theory, a key question for the researcher would be “is this a community development study about SAE (whereas SAE is the context) or is this an SAE study about community development (whereas community development is the context)? We argue a more appropriate framework would exist in community development literature, as this seems to be a central focus to the study.

A final form of mismatch of theory use in a study is using theory to rationalize the study. As Langley et al. (2011) concluded, approximately 30% of research published in the *Journal of Agricultural Education* from 2007-2011 used theory to rationalize the need of a study. When a researcher uses theory to rationalize, she or he uses theory to justify why the research needs to be conducted. This justification aligns with the problem statement rather than providing a foundation for the variables in the study. Clearly, the research problem and need for the study are important pieces of an Introduction to a study. However, using theory in that manner does not accomplish the same goal of providing a theoretical framework for the study itself because there is no rationale behind connections and relationships between or among the variables.

Selecting Low Quality or Previously Discounted Theories

Agricultural education, as a sub-discipline of the very broad discipline of education, can potentially encompass a very broad range of educational and related social science theories. Researchers in agricultural education are often challenged to stay abreast of contemporary and comprehensive theories and literature regarding the myriad of topics that they often investigate. When selecting and using a theory in a study, it is important to carefully examine theory for quality, but also for timeliness. Theories that were once novel may be presently be discounted, or at the least, updated by more contemporary research. Shoemaker et al. (2004) provided several criteria for consideration in evaluating theories:

- Testability (Can you measure the variables/concepts from the theory?)
- Falsifiability (Is the theory specific enough to be disproved?)
- Parsimony (Is the theory as simple as it can be?)
- Explanatory Power (How much can the theory explain?)
- Predictive Power (How much can the theory predict?)
- Scope (How much can this apply?)
- Cumulative Nature of Science (How many studies contribute to the development and refinement of the theory?)

- Degree of Formal Development (To what degree is the theory formalized by the researcher and the field?)
- Heuristic Value (Does this theory help generate ideas for more theory?)
- Aesthetics (Is the theory “beautiful” in it’s own right?)

Shoemaker provides cautions with his list. For instance, Shoemaker noted that Aesthetics is not an essential criterion, but rather a value judgment. Jaccard and Jacoby (2010) also acknowledged scope as a criterion but noted, “there are times when narrow-ranged theories tend to hold up over time than broader-ranged theories” (p. 32). This supports the notion that scope should also be taken into account with caution as a criterion.

To summarize, quantitative research in agricultural education has inaccurately utilized theory under the following circumstances: using grand theories or large-scale conceptual models with little explanatory value, having only a surface-level knowledge of a theory, which leads to either semantic use or mismatch of a theory to a study, or use of low level, outdated, or previously discounted theories. Objective three will attempt to identify some key tenets of appropriate use for theory in agricultural education research.

Tenets of Theory Use in Agricultural Education Quantitative Research

Based upon how agricultural education is situated in the grander research paradigm and the misuse of theory, the following tenets for theory use in quantitative research were provided for consideration. First, researchers should strive to match the proper theory with the study. Related to the SAE example provided earlier in this paper, it is essential to understand the underlying question the research is attempting to answer and separate the context from that underlying question. Once the underlying question has been identified, the researcher should strive to understand the literature base in the field or related fields. A surface-level understanding of theory and related literature will lead to a surface level research question. As Carneiro, Cangussú, and Fernandes (2007) state, “any good science begins with a good question” (p .2). There are no shortcuts to doing good research methodology, but the same goes for the development of the question and theory use. The authors argue that historically, agricultural education research has focused solely on methodology, often times at the expense of a deep understanding of the theory and appropriate literature base for a study.

Secondly, conceptual frameworks can be used in quantitative research in agricultural education, but should not be used void of a theory or a substantive review of the literature by which to support the study. As previously noted, Shoemaker et al. (2004) describes the downfalls of model use as not providing rationale behind the connections between variables. However, Camp (2001) supports using models when using a substantive theory approach, where the model is *fully explained and supported* by a dense literature review. In summary, however, the researcher needs to: have sustained, intellectual engagement in the appropriate literature, question all models, fully understand all theories selected as well as the premises behind them, and finally proceed with framing a study utilizing the appropriate theory to serve as the foundation for the entire study.

Thirdly, researchers, in most cases, should use middle-range and substantive theory in quantitative agricultural education research as opposed to grand theory. Grand theory presents issues for agricultural education as an applied soft discipline and does not allow the researcher to connect findings to a focused body of literature. In short, for most quantitative research in agricultural education, grand theory attempts to explain everything while simultaneously explaining nothing and should be avoided when framing studies.

Finally, for quantitative research in agricultural education, theory should be used in one of the following ways:

1. Theory is used to help develop or guide a program, through which aspects of the program itself it researched (Trifiletti, et al., 2005). Extension, leadership and educational programs could fall under this category of use if said programming is designed by the theory itself.
2. Theory is used to define or prescribe how a variable is measured (Trifilett et al., 2005). If a researcher wanted to study personality type, there are multiple ways to operationalize this variable. If a researcher chose the theory provided by Jung (1990), there is a very specific architecture to which personality type is viewed. The Myers-Briggs Type Indicator could be an appropriate measurement tool based on the theory.
3. Theory is used to test middle-range or substantive theories. In testing theory, experimental design is the most appropriate methodology.
4. Theory is used to articulate and provide rationale behind the relationships between/among variables. For those studies where experimental design is not appropriate, this use category would be most suitable.

Recommendations

Based upon the groundwork established in this study, it is recommended that future studies in agricultural education use these tenets for theory use in quantitative research. It is important to always keep in mind that a solid research question drives the quality of the science (Carneiro, Cangussú, & Fernandes, 2007). The recommended tenets for theory use should lead to a tighter and well-structured literature base, and a much stronger foundation for future studies. As a carpenter would not recommend framing a house on top of a sand pile, the authors of this philosophical paper do not recommend framing a research study with poor theory use. A disproportionate focus on the methods, which ignores good theory use, builds a beautiful house that will sink in the sand.

One of the ways to alleviate a disproportionate focus on methods that negates theory use is to support the development of dense theoretical work. Therefore, it is recommended that the profession not only support but also promote the development of theoretical and philosophical pieces, white papers, and meta-analyses, which develop strong, substantive theory. This can be in the form of current research paper venues (conference and journal) or through supporting white papers as well.

One of the key limitations of this philosophical paper is that it focuses on theory use in quantitative research, and does not include qualitative research. Creswell (1994) noted that theory is used differently in qualitative versus quantitative studies. It is recommended that a philosophical paper regarding the use of theory in qualitative methodologies be developed.

Finally, it is important to note that some research that tends to be program evaluation in nature or some action research can be atheoretical in nature. Atheoretical research is problematic for disciplines (Shoemaker, et al., 2004); however, Thomas (1997) argued that atheoretical research has its place in education. Although atheoretical research can potentially fail to add to the body of knowledge in deep, meaningful ways, it can inform practitioners in specific contexts or provide examples of how educators approach problems of practice. In addition, this paper did not take a stand regarding atheoretical work because of this aforementioned complex conversation. To that end, it is recommended that the profession engage in a conversation about atheoretical work and its place in the profession. Such conversation could lead to the development of a journal that focuses on classroom action, participatory, or program evaluation type research.

References

- American Association for Agricultural Education. (2012). *Membership database*. Retrieved on January 6, 2012 at www. Aaaeonline.org.
- Ary, D., Jacobs, L. C., & Razavieh, A. (2002). *Introduction to research in education, 6th edition*. Belmont, CA: Wadsworth/Thomson Learning.
- Biglan, A. (1973a). The characteristics of subject matter in different academic areas. *Journal of Applied Psychology, 57*(3), 195-203.
- Biglan, A. (1973b). Relationships between subject matter characteristics and the structure and output of university departments. *Journal of Applied Psychology, 57*(3), 204-213.
- Birkenholz, R. J., & Simonsen, J. (2009). Characteristics of distinguished programs of Agricultural Education. *Proceedings of the 36th Annual National Agricultural Education Research Conference, 312-325*.
- Buriak, P., & Shinn, G. C. (1989). Mission, initiatives, and obstacles to research in agricultural education: A national Delphi using external decision- makers. *Journal of Agricultural Education, 30*(4), 14-23.
- Buriak, P., & Shinn, G. C. (1993). Structuring research for agricultural education: A national Delphi involving internal experts. *Journal of Agricultural Education, 34*(2), 31-36.
- Camp, W. G. (2001). Formulating and evaluating theoretical frameworks for career and technical education. *Career and technical education research, 26*(1), 4-25.
- Carneiro, M. A. A., Cangussú, S. D., & Fernandes, G. W. (2007). Ethical abuses in the authorship of scientific papers. *Revista Brasileira de Entomologia, 51*(1), 1-5.
- Creswell, J. W. (2009). *Research design: Quantitative, qualitative, and mixed methods approaches*. Thousand Oaks, CA: Sage Publications, Inc.
- Cruickshank, D. R. (1990). *Research that informs teachers and teacher educators*. Bloomington, IN: Phi Delta Kappa Educational Foundation.
- Crunkilton, J. (1988). Directing future research efforts in agricultural and extension education through a matrix. *Proceedings of 15th National Agricultural Education Research Meeting, 324-346*.
- Doerfert, D. L. (Ed.) (2011). *National research agenda: American Association for Agricultural Education's research priority areas for 2011-2015*. Lubbock, TX: Texas Tech University, Department of Agricultural Education and Communications.
- Dyer, J. E., Haase-Wittler, P., & Washburn, S. G. (2003). Structuring agricultural education research using conceptual and theoretical frameworks. *Journal of Agricultural Education 44*(2), 61-74.
- Edgar, L. D., Edgar, D. W., Briers, G. E., & Rutherford, T. (2008). Research themes, authors, and methodologies in the *Journal of Agricultural Education: A ten year look. Proceedings of the 35th Annual National Agricultural Education Research Conference, 89-104*.

- Lee, J. (1985). *Agricultural education: Review and synthesis of the research* (4th ed.). Information Series No. 298. (Eric Document Reproduction Service, ED260 300).
- Jacard, J., & Jacoby, J. (2010). *Theory construction and model-building skills*. New York: The Guilford Press.
- Jung, C. G. (1990). *Psychological type*. Princeton, NJ: Princeton University Press.
- Langley, G. C., Thieman, E. B., Martin, M. J., Kovar, K. A., Kitchel, T. (2011). The use of theory in agricultural education: A review of JAE articles 2007-2011. *Proceedings of the North Central AAAE Conference*, 54-56.
- Miller, L.E. (1998). Appropriate analysis. *Journal of Agricultural Education*, 39(1), 1-10.
- Neuman, W. L. (2003). *Social research methods, 5th edition*. Boston: Pearson Education, Inc.
- Osborne, E. W. (Ed.) (2007). *National research agenda: Agricultural education and communication, 2007-2010*. Gainesville: University of Florida, Department of Agricultural Education and Communication.
- Radhadkrishna, R. B., & Jackson, G. B. (1995). Prolific authors in the *Journal of Agricultural Education*: A review of the eighties. *Journal of Agricultural Education*, 36(1), 55-63.
- Radhadkrishna, R. B., & Xu, W. (1997). A review of subject matter topics researched in agricultural and extension education. *Journal of Agricultural Education*, 38(3), 59-69.
- Reynolds, P. D. (2007). *A primer in theory construction*. Boston: Pearson Education, Inc.
- Roberts, T. G., Barrick, R. K., Dooley, K. E., Kelsey, K. D., Raven, M. R., & Wigenbach, G. J. (2011). Enhancing the quality of manuscripts submitted to the *Journal of Agricultural Education*: Perceptions of experienced reviewers. *Journal of Agricultural Education*, 52(3), 1-5.
- Santrock, J. W. (2004). *Educational psychology, 2nd edition*. New York: McGraw-Hill Higher Education.
- Shoemaker, P. J., Tankard, Jr., J. W., & Lasorsa, D. L. (2004). *How to build social sciences theories*. Thousand Oaks, CA: Sage Publications, Inc.
- Stringer, E. T. (1999). *Action research, 2nd edition*. Thousand Oaks, CA: Sage Publications, Inc.
- Thomas, G. (1997). What's the use of theory? *Harvard Educational Review*, 67(1), 75-105.
- Trifiletti, L. B., Gielen, A. C., Sleet, D. A., & Hopkins, K. (2005). Behavioral and social sciences theories and models: are they used in unintentional injury prevention research? *Health Education Research*, 20(3), 298-307.
- Wardlow, G. (1989). Alternative modes of inquiry for agricultural education. *Journal of Agricultural Education*, 30(4), 2-6.

Warmbrod, J. R. (1986, March). Priorities for continuing progress in research in agricultural education. Paper presented at the 35th Annual Southern Region Research Conference in Agricultural Education. North Little Rock, AR.

Williams, D. L. (1997). Focusing agricultural education research: An agenda for the graduate student. *Journal of Agricultural Education*, 38(3), 28-35.