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Original Article

Educational Professionals' Knowledge and Acceptance of Evolution

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Abstract: This study sought to determine if we could identify a cadre of educational professionals with sufficient knowledge and acceptance of biological evolution to objectively evaluate the merits of the emerging discipline of *evolutionary educational psychology*. Members of APA and AERA were recruited to complete surveys measuring demographic characteristics, evolution knowledge (specifically natural selection), and evolution acceptance. We tested a model representing propensity toward open-minded examination of the merits of *evolutionary educational psychology*. Results showed evolution knowledge and acceptance, personal beliefs, academic and research experience, were key indicators of willingness to engage in objective evaluation of this new discipline. We conclude that there are a number of educational professionals with sufficient levels of evolution knowledge and acceptance to evaluate the plausibility and applicability of this new perspective.

Keywords: evolutionary psychology, knowledge and acceptance, personal beliefs, professional experience

Introduction

A burgeoning area of research posits that our phylogenic history may have important implications for cognition and learning (see Carlson and Levin, 2007, 2008). From a phylogenic perspective, humans have evolved certain anatomical and physiological configurations which result in cognitive attributes that influence learning (Gazzaniga, 2008). Our anatomical and cognitive structures equip us to make sense of the world beginning in the early stages of development (Gazzaniga, 2008). For example, "naïve theories," evident as early as infancy, which may have been selected for their usefulness in thinking and reasoning in natural environments, place constraints on learning in academic and informal educational settings. Developmentalists describe major milestones in learning as the process of overcoming the constraints posed by naïve theories (Kelemen, 1999). Geary (2007, 2008) similarly describes how learners are endowed with "intuitive biases" or "folk knowledge" of biology, mathematics, physics, and psychology. Geary argues that folk knowledge or naïve theories form a basis for learning and can facilitate some learning tasks, such as the acquisition of language. The learning of more complex concepts, such as those associated with mathematics or physics, may be hampered by the presence of folk knowledge or naïve theories. These findings are leading to the emergence of a new discipline, “evolutionary educational psychology” (Carlson and Levin, 2007).

Evolutionary educational psychology seeks to understand learning as an evolved ability. One goal of this emerging discipline is to understand how the evolution of human cognition differentially impacts domains of study. Specifically, it is speculated that domains that build on the fundamentals of our folk knowledge of psychology, biology, and physics are considered to be *biologically primary* because interactions within these domains have been of fundamental importance to survival (Geary, 2008). Applying this same line of reasoning, it is postulated that domains stemming from cultural inventions such as reading, algebra, or Newtonian physics pose different challenges for learning and motivation. Since these areas of study extend well beyond our evolved learning skill set they are considered to be *biologically secondary*.

Evolutionary educational psychology seeks to understand the advantages of learning in these domains, but also the challenges of overcoming cognitive biases associated with the corresponding foundational folk knowledge. These biases may have developed to provide useful shorthand techniques for recognizing and categorizing objects and others in the environment, but when in contradiction with scientific knowledge in the disciplines, biases may lead to the development of misconceptions. For example, infants are very good at recognizing faces, but our amazing ability to recognize faces may lead to a tendency to superimpose faces when they are not there (such as the face many perceive as the “man in moon”). Thus, biologically primary content may be easy to learn but comes with “baggage” that makes overcoming the associated potential biases pedagogically challenging.

An understanding of the evolved nature of our learning skills and motivational dispositions in the context of different domains may be used to develop more effective instruction. The application of evolutionary educational psychology in the context of domain knowledge can be illustrated by the following example. Children acquire oral language, a biologically primary skill, with relative ease and therefore tend to require less formal instruction to learn to speak, whereas reading, a biologically secondary skill, tends to require systematic structured instruction and sustained effort on the part of the learner to acquire proficiency. The recognition of these domain differences and other aspects of learning that can be understood using an evolution-based perspective supports the possible utility of evolutionary educational psychology.

The increasing reference to evolutionary psychology in cognition research and the associated theory refinement raises the question of whether there is a cadre of researchers or university instructors in *education domains* (what we call educational professionals) with sufficient comprehension and acceptance of biological evolution to adequately and objectively evaluate the merits and validity of this perspective. We contend that this requires experience with scientific research and a working knowledge of and openness to biological evolution. To our knowledge, educational professionals’ levels of understanding and acceptance of biological evolution levels have never been documented.

Knowledge and acceptance of evolution

Developments in evolutionary educational psychology provide justification to examine educational professionals' preparedness to evaluate the merits and plausibility of this perspective. Despite the volumes of evidence supporting the scientific explanation of biological evolution (Dawkins, 1996; Gould, 2002; Miller, 1999) and the abundance of educational materials available to support teaching evolution (Alters and Alters, 2001; National Academy of Sciences [NAS], 1999), research shows that the scientific understanding of biological evolution continues to remain elusive to many (Alters and Alters, 2001; Gallup, 2008). It is argued that evolution is complex and controversial, accounting for why it is either poorly taught or not taught at all in many K-12 settings (Alters and Alters, 2001; Catley, 2006; NAS, 1999). However, studying biology in post-secondary education increases the opportunity to gain deeper understanding of evolution (Alters and Nelson, 2002; Lawson and Worsnop, 1992). This suggests that the number of college level biology courses completed by an individual is a potential indicator of preparedness to evaluate the merits of evolution-based research.

Working knowledge of biological evolution requires the acceptance of natural selection and descent with modification as plausible scientific explanations for speciation and an understanding of the associated variables and processes (Alters and Alters, 2001; Gallup, 2008; Rutledge and Warden, 1999). An accurate understanding of the processes that make up the structure of evolutionary theory is required to effectively generate related models and hypotheses (Alters, 2004; McComas, 2006). We contend that more accurate conceptions of biological evolution enhance the capacity to comprehend and evaluate the plausibility of evolutionary educational psychology. Since advanced courses in biology or evolution are not required for a terminal degree in psychology, educational psychology, or most education fields, it is worth asking whether educational professionals are sufficiently prepared with knowledge of evolution to effectively understand or scientifically evaluate evolutionary educational psychology.

Miller, Scott, and Okamoto (2006) report that the majority of individuals in the United States do not believe in (accept) evolution, which is typically viewed as different from understanding evolution (Rutledge and Warden, 1999; Smith and Siegel, 2004; Southerland, Sinatra, and Matthews, 2001). It has been argued that belief and knowledge are sufficiently different constructs that both must be examined when considering individuals' perspectives on evolution (Shtulman, 2006; Southerland et al., 2001). Those that make this distinction posit that belief is based on faith, whereas knowledge is acquired through observations, logical proof, or empirical evidence (Smith, 1994; Southerland et al., 2001). The distinction may be critical because as Palmquist and Finley (1997) report, professional scientists transitioning to careers in education had difficulty distinguishing their beliefs from their knowledge. Research on acceptance and knowledge of evolution has revealed these constructs to be either associated (Nadelson and Southerland, under review; Rutledge and Mitchell, 2002) or independent (Bishop and Anderson, 1990; Demastes, Settlage, and Good, 1995; Lawson and Worsnop, 1992; Sinatra, Southerland, McConaughy, and Demastes, 2003). The variation in results from research supports the need to investigate these two constructs with our population of interest.

The strong association between acceptance of evolution and belief systems makes individual attitudes toward evolution resistant to change (Southerland and Sinatra, 2003). Over the course of instruction, evolution acceptance is not anticipated to change to the same degree as evolution knowledge (Lawson and Worsnop, 1992). We argue that acceptance of evolution would be predictive of an individual's motivation to engage in the objective evaluation of the merits of evolutionary educational psychology. We contend that rejection of the theory of biological evolution would impede an individual's willingness to give full consideration to this perspective. Individual consideration of whether to accept or reject evolutionary educational psychology requires willingness to objectively examine the idea as plausible, compelling, and comprehensible (Dole and Sinatra, 1998).

Religiosity and evolution

Despite an abundance of evidence supporting the scientific explanation of biological evolution, the majority of individuals in the U.S. neither understands nor accepts the theory (Gallup, 2008: Miller, 1999). Recent Gallup polls (2008) indicate about 80% of Americans believe humans develop only with the influence of God. This reveals perhaps one of the strongest indicators of evolution rejection, an individual's level of religious commitment, also known as religiosity (Alters and Alters, 2001; Mazur, 2004 Miller, 1999; Scott, 2005). The significance of the relationship between acceptance and religiosity is made evident by the anti-evolution movements that have been motivated by individuals who hold strong religious beliefs (Alters and Alters, 2001; Scott, 2005). Although anti-evolution activities have been documented primarily in the United States, recent reports indicate similar movements are occurring in Europe (Graebsch and Schiermeir, 2006) and in Australia (Sutherland, 2005). Lack of evolution acceptance and resistance to learning about the theory are often due to individuals' religious convictions that may conflict with the scientific perspective on humans' phylogenetic relationships to other organisms (Alters and Alters, 2001).

The acceptance or rejection of evolution based on religious perspectives is psychologically analogous to situations in which personal beliefs influence the decision to engage in the consideration of new evidence or perspectives (Kuhn, 1999). The influence and application of personal conceptions or beliefs on decision making can impede the ability to reason scientifically (Tversky and Kahneman, 1982). Kuhn contends that individuals' inability to recognize the influence of their personal beliefs on the evaluation of evidence and concepts constrains their capacity for objective scientific reasoning. Biases against evolution may contribute to the development and reinforcement of fallacies about the theory. The documented association between the rejection of the theory of evolution and levels of religiosity (Alters and Alters, 2002; Trani, 2004) suggests that the constructs interact to impede impartiality required for objective evaluation. The documented influence of religious beliefs on the willingness to consider evolution-based conjectures provides warrant for assessing levels of religiosity in our population of interest.

Evaluating scientific research

Professional experience conducting and evaluating research enhances the domain-general abilities to analyze evidence, scrutinize research methodology, and judge logical arguments supporting new perspectives (Schauble, 1996). The ability to apply scientific reasoning skills that are both domain-specific and domain-general is particularly important with evolutionary educational psychology which combines content domains, sources of evidence, research methodologies, and logical arguments (Carlson and Levin, 2007).

Assessing an individual's knowledge and capability to effectively and objectively weigh scientific evidence regarding evolution is a relatively complex process. There are, however, factors which may serve as proxies for assessing domain-general scientific reasoning capacity. We contend that experience judging evidence (Schunn and Anderson, 1999), conducting research (Kuhn, Amsel, and O'Loughlin, 1988) and evaluating research (Schoenfeld, 1985), are indicators of capacity for effective decision making.

The ability to evaluate scientific research requires expertise in analyzing and critiquing scientific evidence, hypotheses, and theories (Hogan and Maglienti, 2001; Kuhn et al., 1988; Kuhn and Pearsall, 2000). Acquiring expertise in evaluating scientific research is a long term process of developing understanding of when and how to attend to critical variables, explain effects, interpret data, and test hypotheses systematically (Klahr and Simon, 1999; Schoenfeld, 1985). This suggests that the development of the domain-general ability to effectively evaluate scientific research is influenced by exposure and opportunity to engage in and review scientific investigations. Therefore, it stands to reason that increases in educational professionals' academic rank, highest held degree, institutional responsibility, experience with researching or teaching of science, and years of academic experience, would be accompanied by a corresponding increase in the domain-general capacity to effectively evaluate scientific research. This relationship provides justification for assessing professional academic histories and characteristics.

Scientific reasoning

Advances in science require experts to be informed and prepared to reason scientifically to accurately examine and critique new developments (Kuhn, 1970). Sadler and Zeidler (2004) report greater domain-specific content knowledge results in higher quality reasoning abilities. This suggests that scientific reasoning is domain-specific, with individuals' abilities to understand explanations and supporting evidence within a field constrained by their content knowledge. The domain specificity of scientific reasoning is supported by research suggesting individuals can effectively evaluate evidence in some domains but not in others (Schoenfeld, 1985).

We argue that scientific reasoning is best viewed as a combination of domain-general reasoning ability resulting from engagement in the research enterprise (Kuhn et al., 1995; Schauble, 1996), and domain-specific abilities based on content knowledge (Hogan and Magleinti, 2001; Schoenfeld, 1985). Therefore, we posit that the ability to objectively evaluate the merits of evolutionary educational psychology is dependent on individuals' domain-specific knowledge of the theory of evolution, and their domain-general professional scientific research and academic experiences.

Study objectives

The purpose of our study was to determine the propensity for a sample of members of educational professional organizations in the USA to engage in the objective consideration of the merits or shortcomings of evolutionary educational psychology. Our research assessed participants' key personal characteristics, level of religious commitment, research and academic experience, knowledge of evolution (specifically understanding of the process of biological change through natural selection), and levels of acceptance of the theory of evolution. The measured data was used to form a structural model representing educational professionals' preparedness and willingness to objectively examine the validity and credibility of evolutionary educational psychology.

The questions guiding this investigation were:

1. What are the levels of acceptance and knowledge of evolution held by this sample of educational professionals?
2. What is the relationship among participants' knowledge of evolution, acceptance of evolution, and levels of religiosity?
3. How do levels of acceptance and knowledge of evolution vary among the participants in relation to their academic rank, years of academic work, primary academic responsibility, and highest held degree?
4. Do academic experience, individual characteristics, evolution knowledge and acceptance relate to the willingness and ability to objectively consider the plausibility and coherence of evolution-based conjectures?

Methods

Participants

Study participants were 337 educational professionals recruited through their membership in Division 15 (Educational Psychology) of the American Psychological Association (APA), and Division C (Learning and Instruction) of the American Educational Research Association (AERA). The membership of these two organizations is composed in large part of professors, doctoral level researchers, and other graduate students, with primary professional involvement in teaching or research in education or educational psychology. We anticipated the members of AERA Division C and APA Division 15 were to be most likely to encounter situations in which they would be evaluating the merits of evolutionary educational psychology; therefore, we limited our sampling to membership of these two Divisions.

A total of 406 individuals completed the demographics survey, but only 337 completed all three of the study surveys. To maintain confidentiality we did not ask participants to identify their professional affiliation, therefore, we were not able to determine the proportion of the APA Division 15 or AERA Division C membership that responded. However, our goal was not to achieve a representative sample of the population, but instead, to determine if there was a cadre of education professionals prepared to evaluate the plausibility of evolutionary educational psychology.

Data analysis was conducted on the 337 participants who completed all surveys and provided us with full data sets. Of the 337 valid responses, approximately 60% were female and

40% were male. The greater number of women than men in our sample was representative of the gender distribution found in the field of education (Organization for Economic and Co-operation and Development, 2004). Sixty-seven percent held either a Ph.D. or Ed.D. The majority of the participants' degrees were in education, psychology, or educational psychology. About 40% of our respondents indicated that research was their primary institutional activity, 30% indicated teaching, with the remaining 30% indicating administration, service to patients, and other activities (such as graduate student or retired). Almost 45% were tenured or tenure track. Over half had either taken zero or one undergraduate biology course and 80% indicated having taken no graduate level biology courses. The average number of biology courses reported taken by the sample was 5.26 (*SD* = 4.79) and the median was 4.0. Over 50% had conducted research in science, science education, or science learning. The average age was 45.37 years (*SD* = 13.82). See Table 1 for demographics by highest earned academic degree.

Table 1. Demographics based on highest academic degree.

Highest Academic Degree	*n*	Sex	Age	Years of Academic Experience	College Biology Courses *	Experience Researching or Teaching Science Education
		M/F	*M*(*SD*)	*M*(*SD*)	*M*(*SD*)	Yes/No
M.S.	31	26/5	35.48(9.25)	6.23(6.3)	7.39(6.3)	16/15
M.A.	45	14/31	34.13(9.09)	6.24(6.8)	4.49(3.75)	16/29
M.Ed.	31	20/11	38.68(10.46)	6.77(6.47)	4.77(3.89)	14/17
Ed. Specialist	4	0/4	42.00(7.53)	6.50(3.70)	6.50(4.79)	2/2
Ed.D.	27	14/13	56.96(11.59)	20.26(13.16)	7.30(6.79)	14/13
Ph.D.	199	85/114	48.98(13.23)	15.64(13.45)	4.88(4.39)	119/80
Total	337	159/178	45.37(13.82)	12.97(12.51)	5.26(4.79)	181/156

*Number of college level biology courses completed by the participants

Materials and Procedures

The leadership of both APA Division 15 and AERA Division C distributed an e-mail to the organizations' list-serves requesting members' participation in our study. The letter detailed the intent of our investigation and provided a link to a web page that contained instructions for participation, a link to our consent form, and links to our study measures.

All surveys were administered and data collected through Zoomerang, an internet based secure survey web site. Participation was anonymous. Those who did participate were asked to provide the same last five digits of any phone number for each measure which we used as a unique code in our data analysis to track individual responses to our three study measures. Participants were requested to consent to partake in the study and then complete our demographics survey and two study instruments. We used a series of web pages to guide participants through the completion of the surveys, starting with the informed consent, followed by demographics, which included our religious beliefs questions.

Our demographics survey was used to gather personal characteristics data, including gender, ethnicity, highest academic degree, academic rank, and years of academic experience and educational background. We also included items that asked participants to rate their familiarity with the theory of evolution (a measure of participants' perceptions of their general evolution knowledge), level of religious commitment (a measure of religiosity), personal perceptions of the importance of religion (a measure of religiosity), and perceived level of conflict between their individual religious views and personal acceptance of evolution (a measure of evolution acceptance) an item similar to one used by Evans and colleagues (2007). The participants were asked to respond to these four items using a five point Likert scale, with 1 indicating the lowest degree to which the statement was true and 5 the highest degree in which the statement was true. See Table 2 for the average responses to these items.

Once the participants completed our demographics survey, they were directed to the *Measure of Acceptance of the Theory of Evolution* (MATE) (Rutledge and Warden, 1999). This 20-item evolution acceptance questionnaire is scored from 20-100 possible points, with 20 being the lowest level of acceptance and 100 being the highest level of acceptance. The MATE uses items such as, "The theory of evolution is incapable of being scientifically tested," and five point Likert scale with responses ranging from "Strongly Agree" to "Strongly Disagree." In the instrument validation study of participating high school teachers, the reliability of the instrument was determined to be 0.98. The high level of internal reliability reported from previous studies, the construct validation confirmed with high school biology teachers, and the instrument's measure of evolution acceptance, suggest that the MATE was appropriate for use in our study. The corresponding scores and categories for acceptance are; 89-100, Very High Acceptance; 77-88, High Acceptance; 65-76 Moderate Acceptance; 53-64, Low Acceptance; and 20-52, Very Low Acceptance (Rutledge, 1996).

Following the completion of the MATE instrument, the participants were directed to the Conceptual Inventory of Natural Selection (CINS) (Anderson, Fisher, and Norman, 2002). The 20 item CINS instrument uses scenarios and corresponding selected response items to assess knowledge of natural selection, which is a fundamental concept of the theory of evolution (Gould, 2002; Miller, 1999). There are multiple processes guiding evolution, however, natural selection is an essential and dominant mechanism. The salience of natural selection to the understanding of evolution provided justification for inferring our participants' general knowledge of evolution based on their CINS scores. Further, there is a dearth of extant instruments available to assess general knowledge of evolution. Therefore, we used the CINS, an instrument with established reliability and validity, to assess our participants' knowledge of natural selection and infer their general knowledge of evolution from these scores.

In the development of their instrument, Anderson et al. (2002) assessed undergraduate students targeting a level of difficulty of 50%, and achieved a level of 46.4% correct. This indicates that individuals with a science background similar to that of an undergraduate would be expected to answer about 50% of the questions on the CINS correctly. In their description of the

CINS instrument Anderson and colleagues reported sufficient construct validity and adequate levels of reliability (KR_{20} = .64). The validation with undergraduates with limited biology knowledge, the demonstration of instrument internal reliability, and the assessment of knowledge of natural selection supports the use of the CINS as an appropriate assessment of participants' knowledge of evolution. Once the CINS was completed the participants were directed to a web page which thanked them for their participation and again provided them with our contact information.

Results

Instrument reliability

We began our analyses with a determination of the reliability of the MATE and the CINS. Our analysis of the MATE began with recoding the reverse coded items. Maintaining the five point Likert scale, the SPSS based internal reliability analysis produced a Cronbach's alpha value of .96, indicating a high level of instrument reliability.

The CINS responses where recoded to dichotomous values of 0 for incorrect and 1 for correct. Although it is appropriate to apply the Kuder-Richardson-20 test of reliability for dichotomous data, the outcome and process used in SPSS for the calculation of the KR-20 and Cronbach's alpha resulted in the same values. The Cronbach's alpha reliability analysis of the CINS using SPSS resulted in a value of .86, indicating that for our application the instrument was revealed to have a high degree of internal reliability.

Religiosity views

Our participants responded to the question regarding their level of religious commitment with a mean of 2.66 (*SD* = 1.35) which would fall between "minimally religious" and "somewhat religious" on our Likert scale (see Table 2). Approximately 49% of participants responded as "not religious" or "minimally religious," 21% responded as "somewhat religious," and 31% responded with "religious" or "very religious". It is interesting to note that the participants were nearly equally distributed on the five point scale, which indicates that our sample includes individuals with a broad range of religious commitment. In an effort to provide a context for interpreting our participants' level of religiosity and to establish a reference for future analysis, we made an attempt to compare the religiosity of our sample to outcomes from Gallup (2008) and other reports of various behavior measures associated with religious commitment of the general public (e.g. church attendance). However, we could not locate any data that were similar enough to allow for a direct comparison of the religious commitment of our sample and the general public.

Table 2. Means and standard deviations for the Measures of Religiosity, and the Knowledge of Evolution and Acceptance of Evolution scales (*n* = 337).

Measure	*M*	*SD*
Level of religious commitment (Scale 1 - 5)	2.66	1.35
Importance of religion (Scale 1 - 5)	2.95	1.47
Familiarity with evolution (Scale 1 - 5)	3.63	.91
Knowledge of Evolution (CINS) (Scale 0 - 20)	15.41	4.26
Religious beliefs compatible with evolution (Scale 1 - 5)	3.97	1.15
Acceptance of Evolution (MATE) (Scale 20 – 100)	87.77	13.41

The distribution of participants' responses to our question regarding personal importance of religion was very similar to our item assessing perceived religious commitment. The average of 2.95 (*SD* = 1.47) placed our participants very near "somewhat important" for our measure of the personal importance of religion (see Table 2). The similarity in responses to our *importance of religion* item and the previous item examining *religious commitment* provided evidence of consistency in our measures of religiosity. The correlation between religious commitment and importance of religion was $r(337) = .90$, $p < .01$. This indicated there was a high level of shared variance between these two items. The high level of correlation between these items provided justification for combining the two measures to form a single composite variable representing of our participants' levels of religiosity.

Acceptance and knowledge

We began our main analyses of interest by examining our first research question: *What are the levels of acceptance and knowledge of evolution held by this sample of educational professionals?* The MATE measure of evolution acceptance uses a scale of 20 (representing no acceptance) to 100 (representing full acceptance). Over 75% of our participants scored in the 80 to 100 range on the MATE. This indicates that the majority of our participants rated their level of acceptance of the theory of evolution as *High* to *Very High* acceptance (Rutledge, 1996). The mean score of our 337 participants, 87.77 (*SD* = 13.41), was significantly higher [$t(887) = 16.52$, $p < .01$] than the levels of acceptance of a previous study that examined the acceptance of evolution of 552 high school biology teachers in which Rutledge and Warden (2000) reported a mean of 77.59 (*SD* = 4.26) on the same scale. This indicates that participants in our sample had significantly higher levels of acceptance of the theory of evolution than the biology teachers assessed in a prior study. This was intriguing since our participants reported taking about half the number of college level biology courses on average (*M* = 5.26, *Mdn* = 4.0 *SD* = 4.79) than recommended for biology teacher certification (National Science Teacher Association, 1992). See Table 2 for the means and standards deviations of the MATE.

To further assess acceptance of evolution we examined the response to our single item which asked participants to rate the compatibility between their religious beliefs and evolution. Approximately 78% of our sample indicated “compatible” or “very compatible” with a mean of 3.97 (*SD* = 1.15) placing them near “compatible” on our Likert scale. In comparison, a Gallup (2008) survey of the U.S. public with regard to their perspectives of evolution, creation and religion, reported that about 35% of the U.S. public expressed personal views in the context of evolution indicating they perceived that science and religion conflict with each other. It is important to note that the wording of the questions can result in shifts in the percentages of acceptance responses. Overall, the polls reflect relatively little change in acceptance over the past 40 years. This indicates that a greater proportion of our study participants perceive no conflict between science and religion than one would expect to find in the general public. This is a notable finding as it indicates a higher degree of comfort level with evolution and personal beliefs than we would most likely detect in the general public. Again, comparing the perspectives of our participants and the general public is important to establishing a frame of reference for the outcome on our measure of compatibility.

We conducted a correlation analysis to determine the consistency of the acceptance of evolution outcomes from the MATE and our item asking participants’ to rate the level of compatibility between evolution and their religious beliefs. The results revealed the MATE was positively correlated with our measure of compatibility of religious views and the scientific view of evolution, $r(337) = .49$, $p < .01$. This indicated that these two measures had some consistency. However, over 75% of the shared variance remained unaccounted for, indicating that our measures also assessed some unique aspects of evolution acceptance.

Analysis of the CINS, our measure of evolution knowledge (inferred from knowledge of natural selection), revealed that approximately 65% answered correctly on 75% or more of the questions. Anderson et al. (2002) reported that the CINS instrument was designed to have a 50% correct targeted level of difficulty, and achieved a 46.4% correct with a large sample of undergraduates. In comparison our sample had a mean of 77.05% correct (*SD* = 21.25%), which was greater than the expected 50% targeted level of difficulty. This indicates that the majority of our participants scored above the average expected levels of understanding of natural selection (our measure of knowledge of evolutionary processes) for this instrument. See Table 2 for the means and standards deviations of the CINS.

To extend our assessment of evolution knowledge we examined the responses to our single item which asked participants to rate their familiarity with the theory of evolution. The participants self-reported a perceived average level of familiarity with evolution of 3.62 (*SD* = .91) which fell between “somewhat familiar” and “familiar” on our Likert scale. All 337 of our participants rated their familiarity at or above “minimally familiar” with 32% responding at “somewhat familiar,” 38% at “familiar,” and about 18% at “very familiar.” We were unable to locate any appropriately similar studies that we could justify using for comparison to the general population, but our awareness of research on levels of evolution knowledge suggests our participants considered themselves more familiar with evolution than the general public would be likely to rate themselves (Alters and Alters, 2001; Miller, 1999; Scott, 2005).

To determine the extent of the relationship between our two measures of evolution knowledge, we conducted a correlational analysis between the CINS and our single item assessing familiarity with evolution. The results revealed the CINS was positively correlated with our measure of evolution familiarity, $r(337) = .27$, $p < .01$. This indicated that these two measures had some level of consistency. However, over 92% of the shared variance remained unaccounted for indicating that these two measures were likely assessing nearly independent aspects of evolution knowledge.

Relationship between acceptance, knowledge and religiosity

Our second research question asked: *What is the relationship among participants' knowledge of evolution, acceptance of evolution, and levels of religiosity?* We examined the correlations among participants' ages, years of academic experience, the religiosity composite, MATE scores, the measure of compatibility of personal beliefs and evolution, the measure of perceived familiarity of evolution, CINS scores, number of biology courses as variables, and experience with research or teaching of science (see Table 3 for the correlation matrix). The results revealed acceptance scores on the MATE to be significantly correlated with knowledge of evolution (as measured by the CINS), $r(337) = .38$, $p < .01$. The MATE scores were also found to be significantly correlated with perceived evolution familiarity, $r(337) = .28$, $p < .01$. Further, the CINS was found to be positively significantly correlated with evolution compatible views, $r(337) = .35$, $p < .01$. This indicated that as evolution acceptance increased there was a corresponding increase in evolution knowledge, which is a relationship that has been inconsistently detected in prior research on the association within populations of undergraduate and graduate college students (Bishop and Anderson, 1990: Demastes et al., 1995; Lawson and Worsnop, 1992; Nadelson and Southerland, under review; Rutledge and Mitchell, 2002; Sinatra et al., 2003).

Consistent with other research in this area (Gallup, 2008; Trani, 2004), we found religiosity to be significantly inversely correlated with acceptance of evolution (MATE scores), $r(337) = -.45$, $p < .01$, and inversely correlated with compatibility of beliefs and evolution, $r(337) = -.12$, $p < .05$, such that higher levels of reported religiosity were associated with lower levels of reported acceptance and of evolution compatible views. In addition, religiosity was also found to be significantly and negatively correlated with the CINS, $r(337) = -.13$, $p < .05$. It is interesting to note that we failed to detect a correlation between religiosity and participants' perception of their familiarity with evolution. Our results show that as religious commitment increases there were significant decreases in both evolution acceptance and knowledge. This corresponds with the interpretation of Gallup poll results (2008) which report that understanding of evolution, acceptance, and level of religious commitment are related in the same directions as found in this study.

Table 3. Correlations of measures.

Measure	1	2	3	4	5	6	7	8	9
1. Age	--	.84**	.04	.12*	.14*	.04	.02	.01	.01
2. Years of experience		--	-.02	.14*	.13*	.05	.04	-.01	.03
3. Religiosity			--	-.12*	-.45**	.08	-.18**	-.03	-.13*
4. Religious beliefs compatible with evolution				--	.49**	.14*	.35**	.05	.11*
5. Evolution acceptance (MATE)					--	.28**	.38**	.09	.22**
6. Familiarity with evolution						--	.27**	.41**	.22**
7. Evolution knowledge (CINS)							--	.16**	.32**
8. College level biology courses completed								--	.21**
9. Experience teaching or researching science									--

*$p < .05$, **$p < .01$

Variations with academic experience

Our third research question asked: *How do levels of acceptance and knowledge of evolution vary among the participants in relation to their academic rank, years of academic work, primary academic responsibility, and highest held degree?*

Academic rank. We conducted an ANOVA to explore differences among the measures with respect to academic rank. Levels of academic rank were used as the grouping factor and acceptance of evolution, knowledge of evolution, level of religiosity, and experience with research or teaching of science served as dependent measures. The results revealed significant differences in the acceptance of evolution (MATE) depending on academic rank, $F(5,331) = 5.97$, $p < .01$. Post hoc analysis revealed that Instructors had significantly lower levels of acceptance than Lecturers ($p < .05$), Assistant Professors ($p < .05$), Associate Professors ($p < .05$), and Full Professors ($p < .01$). Further analysis of the pairwise comparisons revealed that Graduate Students had significantly lower levels of acceptance of evolution than Assistant Professors ($p < .05$) and, Full Professors ($p < .01$). All other post hoc comparisons were not significant.

We then conducted an ANOVA to determine if compatibility of religious beliefs with evolution differed by levels of academic rank. This result was significant $F(5,331) = 3.19$, $p < .01$. The post hoc analysis identified Instructors as reporting significantly lower levels of compatibility than Full Professors ($p < .05$). All other post hoc comparisons were not significant.

Knowledge of evolution (as measured by the CINS), familiarity of evolution, experience with researching or teaching science, and levels of religiosity were not found to vary by academic rank. The means and standard deviations for acceptance, knowledge, religiosity, compatible beliefs, and engagement in science research and teaching by academic rank are presented in Table 4.

Table 4. Academic rank and measures of gender, acceptance, knowledge, religiosity, compatibility of beliefs, and engagement in research on science education.

Academic Rank	*n*	Sex	MATE * (Scale 20-100)	Evolution Compatible Beliefs (Scale 1-5)	CINS ** (Scale 0-20)	Familiarly with Evolution (Scale 1-5)	Religiosity (Scale 1-5)	Experience Researching or Teaching Science Education (Scale 0-1)
		M/F	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Professor	71	43/28	91.83 (9.36)	4.23 (1.05)	16.00 (4.09)	3.63 (.96)	2.86 (1.27)	.58 (.50)
Associate. Professor	45	21/24	89.31 (11.47)	4.09 (.97)	16.58 (3.85)	3.78 (.90)	2.60 (1.43)	.58 (.50)
Assistant Professor	69	24/45	89.81 (11.24)	4.13 (1.08)	15.30 (4.47)	3.57 (.83)	2.76 (1.35)	.61 (.49)
Lecturer	37	11/26	89.94 (11.12)	3.97 (1.24)	15.35 (3.74)	3.70 (.88)	2.61 (1.45)	.51 (.51)
Instructor	22	8/14	79.13 (22.01)	3.36 (1.29)	14.09 (4.81)	3.77 (1.02)	3.11 (1.38)	.55 (.51)
Graduate. Student	93	22/71	83.59 (14.85)	3.73 (1.22)	14.80 (4.38)	3.55 (.94)	2.91 (1.42)	.44 (.50)

*Measure of the Acceptance of the Theory of Evolution, **Conceptual Inventory of Natural Selection

Highest degree earned. To determine if measures of acceptance, knowledge, religiosity, and experience with research or teaching science were related to highest degree obtained, we conducted an ANOVA using the highest degree obtained as the grouping factor. The results of this analysis revealed that levels of acceptance of evolution (MATE) varied with respect to the highest degree obtained, $F(5,331) = 7.35$, $p < .01$. The post hoc analysis of MATE scores revealed those holding a Ph.D. had significantly higher levels of acceptance than those holding a M.A. ($p < .01$) or an M.Ed. degree ($p < .01$). The ANOVA also revealed significant differences in levels of compatibility of religious beliefs with evolution by highest degree earned, $F(5,331) = 2.46$, $p < .05$. Post hoc analysis revealed a significant difference between M.Ed. and Ph.D. participants ($p < .05$). The nature of this difference was that those holding a Ph.D. had higher levels of compatibility than the M.Ed. participants. The ANOVA examining evolution knowledge (as measured by the CINS) by highest degree obtained was revealed to be significant, *F*(5,331) = 3.85, *p* < .01. The post hoc analysis indicated that those holding a Ph.D. showed significantly higher understanding scores than those holding M.A. degrees (*p* < .01). It is interesting to note that the ANOVA examining perceptions of evolution familiarity, failed to reach significance. This further confirmed our analysis that the CINS and evolution familiarly were assessing different aspects of our participants' evolution knowledge.

We detected no significant differences for religiosity or experience with researching or teaching science across degree groups. This led us to conclude that these measures were not differentially distributed within the degree groups. The means and standard deviations for the examined measures are presented in Table 5.

Table 5. Highest held degree, knowledge, acceptance, religiosity, engagement in science learning/teaching research, and compatibility of views.

Highest Academic Degree	*n*	Sex	MATE * (Scale 20-100)	Evolution Compatible Beliefs (Scale 1-5)	CINS ** (Scale 0-20)	Familiarly with Evolution (Scale 1-5)	Religiosity (Scale 1-5)	Experience Researching or Teaching Science Education (Scale 0-1)
		M/F	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
M.S.	31	5/26	86.10 (14.70)	3.81 (1.3)	15.65 (4.09)	3.84(1.00)	2.82 (1.31)	.52(.51)
M.A.	45	14/31	82.56 (16.57)	3.89 (1.17)	13.31 (4.53)	3.49 (.84)	3.03 (1.46)	.36 (.48)
M.Ed.	31	11/20	80.03 (18.16)	3.45 (1.31)	14.94 (4.18)	3.52 (.93)	3.15 (1.46)	.45 (.51)
Ed. Specialist	4	0/4	73.50 (18.65)	3.25 (1.50)	12.50 (3.00)	3.25 (.50)	2.00 (1.41)	.50 (.58)
Ph.D.	199	85/114	90.93 (9.29)	4.12 (1.05)	16.06 (4.03)	3.63 (.94)	2.65 (1.34)	.60 (.49)
Ed.D.	27	14/13	86.11 (14.44)	3.89 (1.29)	14.81 (4.74)	3.81 (.74)	3.33 (1.26)	.52 (.51)

*Measure of the Acceptance of the Theory of Evolution, **Conceptual Inventory of Natural Selection

Years of experience. We conducted a correlational analysis between age and years of academic experience and found a significant relationship, *r*(337) = .84, *p* < .01. This strong positive correlation suggested that analysis conducted using both age and years of experience as independent variables would result in redundant outcomes. Furthermore, years of academic experience was our construct of interest. Therefore, we did not use age but only used years of academic experience in our subsequent analysis. See Table 3 for all correlational outcomes.

We conducted a correlational analysis to determine if years of academic experience were significantly related to acceptance of evolution, knowledge of evolution, experience with researching or teaching science, and religiosity. Our results indicate that years of experience was significantly correlated with acceptance of evolution (MATE) *r*(337) = .14, *p* < .05. Years of experience was also found to be significantly correlated with compatibility of faith and evolution, *r*(337) = .12, *p* < .05. Our correlational analysis failed to detect significant relationships between years of experience and understanding of evolution (as measured by the CINS), perceived familiarity of evolution, experience with researching or teaching science, or levels of religiosity.

This indicates that years of academic experience is not a predictor of evolution knowledge or religious commitment, but as years of experience increased there was an increase in the acceptance of evolution. This was consistent with our argument that an individual's years of academic experience is linked to the development of domain-general scientific reasoning abilities which increases their capacity to objectively consider the plausibility of evolution.

College level biology courses. The number of college level biology courses was found to be significantly correlated with understanding of evolution (CINS), $r(337) = .16$, $p < .01$, and familiarity, $r(337) = .41$, $p < .01$. This indicates that as the number of biology courses increased evolution knowledge also increased. The number of college level biology courses was also found to be significantly correlated with experience with research or teaching science, r(337) = .21, $p < .01$, which indicated that as the number of biology courses increased so did experience with researching or teaching science. However, the number of college level courses was not found to be significantly correlated with acceptance (MATE) or with our measure of compatibility leading us to conclude that study in biology does not necessarily lead to increased levels of evolution acceptance. No correlational relationship was detected between the number of college level science courses and religiosity.

Institutional responsibility. We conducted an ANOVA using primary institutional responsibility as the grouping factor and our two measures of evolution acceptance, two measures of evolution knowledge, experience with researching or teaching of science, and religiosity as dependent variables. Our analysis revealed significant differences in MATE scores, $F(4,332) = 4.20$, $p < .01$, but no significant difference was found for evolution compatible views. A significant difference between institutional responsibility groups was found for CINS scores, $F(4,332) = 2.53$, $p < .05$, but no difference was detected for our perceived familiarity with evolution item. Post hoc analysis showed that those whose primary professional responsibility was providing service to clients or patients held significantly lower MATE scores than participants who indicated that their primary responsibility was research ($p < .01$), teaching ($p < .01$), or other (retired, educational assessment, etc.) ($p < .01$). Our post hoc analysis revealed that those whose primary activity was service to clients or patients had significantly lower CINS scores than participants who indicated that their primary responsibility was research ($p < .05$). We did not detect any relationships between primary institutional responsibility and religiosity or experience with research or teaching science. See Table 6 for the means and standard deviations for the measures presented by primary institutional responsibility.

Table 6. Institutional responsibility, knowledge, acceptance, religiosity, engagement in scientific research, and compatible views with evolution.

Institutional Responsibility	*n*	Sex	MATE * (Scale 20-100)	Evolution Compatible Beliefs (Scale 1-5)	CINS ** (Scale 0-20)	Familiarly with Evolution (Scale 1-5)	Religiosity (Scale 1-5)	Experience Researching or Teaching Science Education (Scale 0-1)
		M/F	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)	M(SD)
Administration	33	15/18	85.42(16.03)	4.00 (1.25)	15.12(4.01)	3.61 (.93)	3.09(1.35)	.48(.51)
Teaching	105	38/67	87.55(13.59)	4.00(1.10)	15.22(4.64)	3.60 (.93)	2.66(1.31)	.47(.50)
Research	134	49/85	89.56(12.33)	4.00(1.10)	16.07(3.92)	3.67 (.89)	2.57(1.35)	.63(48)
Services to clients	13	2/11	74.54(18.68)	3.38(1.29)	12.54(3.69)	3.54 (1.13)	3.08(1.44)	.46(.52)
Other	52	25/27	88.40(10.60)	3.94(1.29)	15.00(4.31)	3.63 (.91)	2.54(1.38)	.51(50)

*Measure of the Acceptance of the Theory of Evolution, **Conceptual Inventory of Natural Selection

Modeling evolution acceptance

Our fourth research question stated: *Do academic experience, individual characteristics, evolution knowledge and acceptance relate to the willingness and ability to objectively consider the plausibility and coherence of evolution-based conjectures?* As discussed previously, we hypothesized that there would be a significant interaction between knowledge of evolution, academic and research experience, and acceptance of evolution on the ability to objectively consider the merits of evolutionary educational psychology. We set out to determine if it was possible to model the relationships between these variables in a manner that would be indicative of the interplay of the measures associated with the objective consideration of the plausibility and applicability of the proposed evolutionary educational psychology. The three latent variables from our model are presented with the corresponding measured variables in Table 7.

Table 7. The three latent variables and the associated measured variables.

Latent Variable	Measured Variables
Knowledge of Evolution - *Knowledge*	1. CINS composite score 2. Perceived Familiarity with Evolution 3. Number of College Biology Courses 4. Research or Teaching Science
Academic and Research Experience - *Experience*	1. Principal Academic Activity 2. Highest Degree Held 3. Years of Academic Experience
Accepting Willing and Able to Engage in the Consideration of The Plausibility and Merits of Evolutionary Based Conjectures – *Acceptance of Evolution*	1. MATE composite score 2. CINS composite score 3. Evolution Compatible Views 4. Religiosity 5. Research or Teaching Science

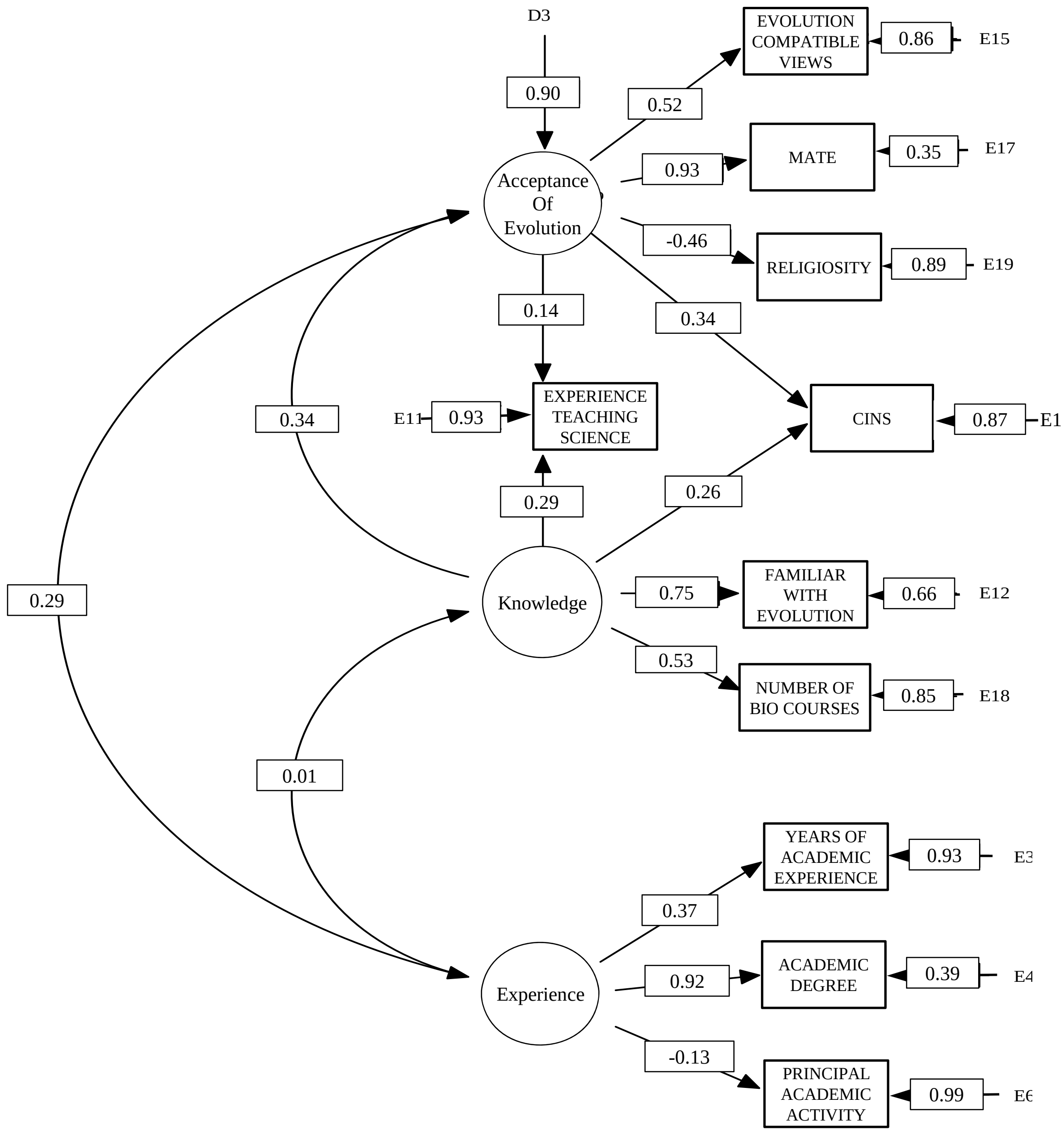
The measurement model

The analysis to confirm our proposed model began with a test of our measurement model, followed by a test of our full structural model. We tested all models using EQS 6.2 structural equation software (Bentler, 1995), and consulted Byrne (2006) for confirmation of our outcome interpretation.

In our measurement model we tested three factors; experience with academic research, knowledge of evolution, and willingness and ability to engage in the consideration of the plausibility and merits of evolution-based conjectures. To test our measurement model, we limited most of the model measures to a single factor, with two exceptions. Both the measure of evolution knowledge (CINS) and the measure of research engagement were linked to our knowledge factor and willingness factor. We fixed the residuals to be uncorrelated, placed no constraints on the loadings, and allowed the factor covariances to be freely estimated.

We used both the fit indices and the factor correlations as empirical indicators for justification in the formation of a hypothesized model. Goodness-of-fit indices indicated a decent to good measurement model to data fit: χ^2 (30, N = 337) = 62.61 $p < .05$, CFI = .93, GFI = .96, AGFI = .94, Standardized RMS = .05, RMSEA = .06, and the 90% Confidence Interval of the RMSEA between .04 and .08. See Figure 1 for correlations and measurement model structure.

Figure 1. Factor loadings and standard errors are shown for each item and correlations are shown between factors.



Note: The circles represent the latent variables and the rectangles represent the measured variables. The *Knowledge of Evolution* and *Experience* latent variables are independent and the *Acceptance of Evolution* latent variable is dependent.

An assessment of the fit indices indicated that the three factor inclusion was justified in our model. Further, the resulting correlations, presented in Table 8 revealed a reasonable level of correlation between capacity to engage in the objective consideration of evolution developments based on factors for acceptance, academic experience, and knowledge of evolution. This led us to presume that there were acceptable levels of consistency in the measures, and no obvious occurrences of collinearity of measurement. The correlation of r = .01 between our academic experience and knowledge of evolution latent variables (see Table 8) indicates that these variables are measures of different constructs that are responded to with different consistencies. Yet, the considerably higher correlations between our experience variable and acceptance variable (hypothesized to be a predictor of the likelihood of engaging in the consideration of evolutionary developments) and our knowledge and acceptance variables (r = .29 and r = .34 respectively), provides justification for the use of knowledge and experience as predictors of acceptance in our proposed model.

Table 8. The correlations among the three study latent variables.

	Knowledge	Acceptance	Experience
Knowledge of Evolution	--		
Acceptance of Evolution	.34*	--	
Experience in Academics	.01	.29*	--

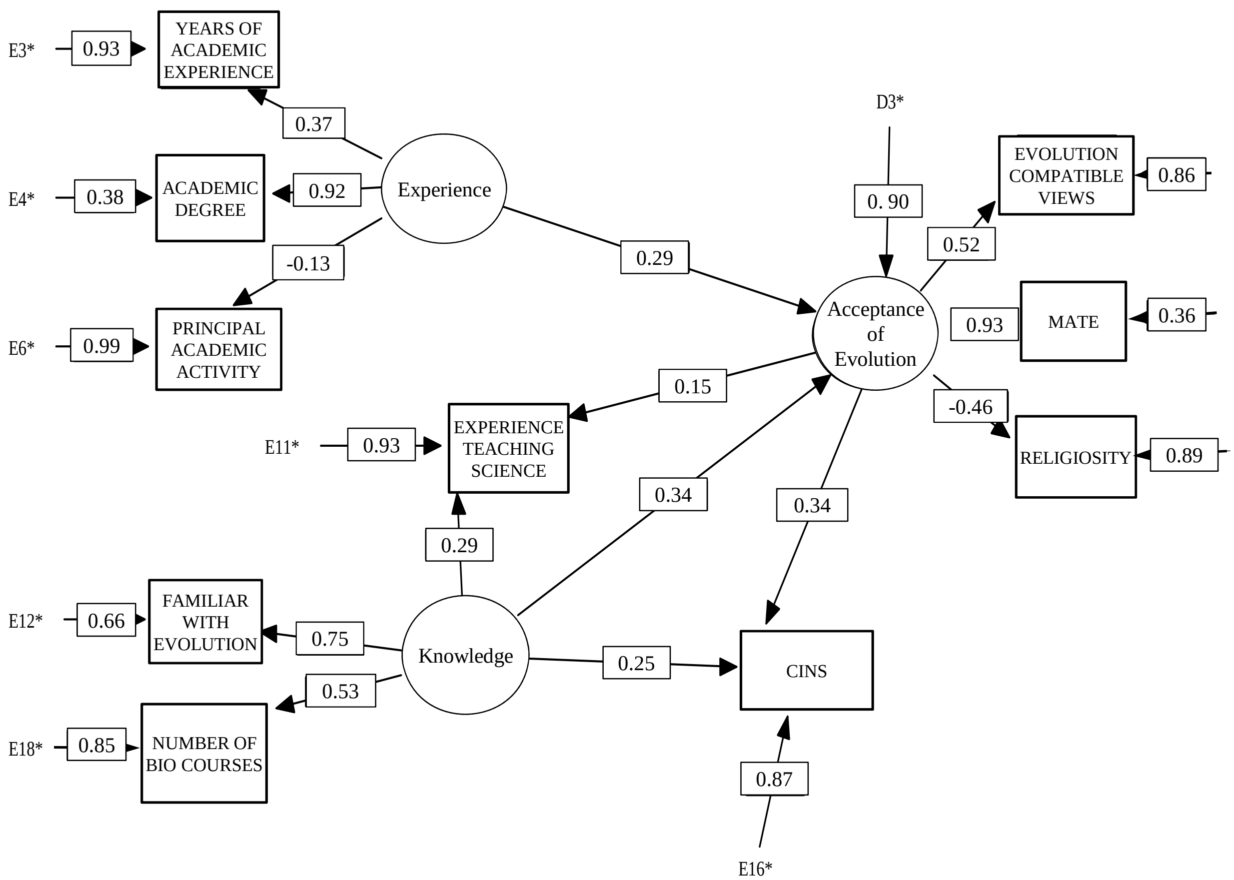
*$p < .05$

A proposed model

Based on the outcome of the measurement model, the content analysis of the factors, and the literature, we maintain that the ability to objectively engage in scientific thinking is a complex interaction of variables. Our analysis indicated a significant correlation between our three factors; knowledge of evolution, academic experience, and capacity to objectively consider the plausibility and merits of evolution-based developments. This provided empirical support for our position that educational professionals' capability to objectively judge the merits of, and evidence for, an evolutionary perspective of educational psychology is dependent on several factors. Thus, we relied upon both theoretical and empirical support in the development of our model.

Taking these factors into consideration, we proposed and tested the following model representing the influence of knowledge of evolution and academic experience on the ability to engage in the objective consideration of the plausibility and merits of evolution-based developments (see Figure 2). We developed this model based on the notion that both domain-general reasoning abilities and domain-specific knowledge influence the ability to engage in unbiased examination and interpretation of evidence. In our proposed model, the objective consideration of the plausibility of evolution-based developments is directly influenced by knowledge of evolution (domain-specific knowledge) and academic experience (domain-general reasoning abilities). Our model reflects the notion that the domain-specific and domain-general variables that we measured can be used directly and indirectly to predict educational professionals' ability to engage in the unbiased evaluation of evolution-based developments. We posit the ability to engage in unbiased evaluation of evolution-based developments predicts the propensity for the objective consideration of the merits of evolutionary educational psychology.

Figure 2. Our hypothesized model for educational professionals' acceptance of the theory of biological evolution.



Note: The circles represent the latent variables and the rectangles represent the measured variables. The *Knowledge of Evolution* and *Experience* latent variables are independent and the *Acceptance of Evolution* latent variable is dependent.

The goodness-of-fit statistics indicated that the model fit the data fairly well. The results revealed that most fit statistics were near the suggested threshold values suggested by Byrne (2006) for an acceptable model, χ^2 (31, N = 337) = 62.63 $p < .05$, CFI = .93, GFI = .96, AGFI = .94, Standardized RMS = .05, RMSEA = .05, and the 90% confidence interval of the RMSEA between .03 and .07.

Levels of acceptance are critical to objective evaluation of the merits of a proposed hypothesis (Kuhn, 1970). In our model, we represented willingness to engage in the consideration of the merits of evolution-based conjectures as measured by evolution acceptance, knowledge, and religiosity. We combined the influences of domain-specific knowledge of evolution and domain-general experience with research to forecast willingness to engage in the evaluation of evolution-based developments. Applied to our research this suggests that levels of understanding of evolution and academic experience predicts the likelihood that an individual is prepared to objectively evaluate the merits of evolutionary educational psychology.

The analysis of our model confirmed the direct influence of acceptance of evolution, religiosity, knowledge of evolution, and experience with researching and teaching science, on the willingness and capacity to engage in evaluating evolution-based developments. We also confirmed the indirect influence of academic experience measures and additional knowledge of evolution measures. This supports our posited relationship between measures of domain-specific evolution knowledge, domain-general research experience, and measures of acceptance of evolution as key indicators of the willingness and capacity to engage in unbiased evaluation of evolutionary educational psychology research and hypotheses.

Discussion

Evolutionary educational psychology (Carlson and Levin, 2007) is a new and emerging sub-discipline within the field of educational research. Our interest and experience researching students' and teachers' knowledge and acceptance of evolutionary biology led us to question whether there was a cadre of educational researchers and other post secondary education professionals who were prepared to interpret, utilize, and evaluate the merits of this new perspective. To our knowledge, no other study has examined levels of knowledge and acceptance of biological evolution within a select sample of the community of educational psychologists, educational researchers, and other education professionals who teach and mentor the next generation of educators and educational researchers.

Our results suggest that there is an informed, sizable subgroup (recall our sample size was well over 300 individuals) of educational professionals that exhibit preparedness to evaluate this new view of learning and cognition. In interpreting these findings, is important to note that our participants do not constitute a random or a representative sample of the populations of all educational psychologists, educational research, or education professionals. Although efforts were made to recruit as many participants as possible from the population of educational professionals, only those who had the time and interest in participating completed our surveys. This process of self selection for participation means we cannot generalize from this sample to make any claims characterizing the population of all educational psychologists and other education professionals. However, it is important to note that accurately describing the population of professional educators as a whole, while a worthwhile endeavor, was not our objective. Rather we sought to determine if there was a sufficient base of individuals within the educational professional community to effectively evaluate evolutionary theory's relevance to educational psychology. This base of individuals does not have to be representative of the members of our discipline any more than determining whether there is a cadre of biologists prepared to conduct taxonomic analyses of certain microbial extremophiles. As with our study, it would be reasonable to determine if there were professionals within the population of biological scientists with the potential to accurately classify these unique organisms. Our results suggest that there is an informed group among those in the profession who likely can evaluate evolutionary educational psychology.

Another limitation of our study was that although we achieved a high level of reliability with both of our instruments, they are self-report measures. Due to our desire to limit the scope of the surveys, minimize the time required to complete them, and maximize the completion rate, we chose not to collect qualitative data that may have provided additional insight into the perspectives held by the participants. This is an excellent direction for future research.

An additional instrument related limitation of our study is the reliance on the CINS (Anderson et al., 2002) as a measure of general knowledge of evolution. We recognize the CINS is constrained to assessing knowledge of natural selection, albeit from a broad perspective. However, given the limitation of extent instruments to assess comprehensive knowledge of evolution, and the centrality of natural selection to broader themes in evolution, we chose the CINS for its clear utility for examining our research questions. The development of an instrument that assesses comprehensive evolution knowledge is an excellent focus for future research.

Our findings indicate that the relationships among understanding and acceptance of biological evolution and experience with research and scientific reasoning may impact the ability of educational professionals to objectively evaluate the merits and evidence supporting educational evolutionary psychology (Hogan and Maglienti, 2001; Kuhn and Pearsall, 2000). Although our participants' range of knowledge of evolution, acceptance of evolution and measures of religiosity were found to be consistent with previous research, (Anderson, et al., 2002; Gallup, 2008; Rutledge and Warden, 2000) our sample was revealed to have higher levels of knowledge of evolution (specifically the process of natural selection) than expected, higher levels of acceptance of evolution than expected, and greater compatibility of religion and evolution than found in previous studies. This is likely due to the self-selected nature of our sample of participants, and this finding cannot be generalized to educational professional as a whole.

Our analyses revealed that several variables including years of academic experience, principal academic responsibility, level of education, number of college level biology courses, experience with researching and teaching science, and degree of religiosity, were significantly associated with the acceptance and/or the understanding of evolution. It is important to note the results revealed no correlation between the number of courses and acceptance of evolution. This suggests that knowledge of evolution requires exposure to domain-specific content, but acceptance may come from domain-general understanding of theories and scientific knowledge. This lends support to our argument that the combination of domain-specific and domain-general measures are essential for determining capacity to objectively consider evidence for an evolutionary educational psychology perspective.

As new developments and evidence emerge in evolutionary educational psychology, it is essential that future generations of educational professionals are prepared to evaluate the merits of new findings. Our data indicates that there are individuals within the profession who may be positioned to respond to this need. Our results also revealed that participants with M.A.s and M.Ed.s had constrained knowledge of evolution, experience in scientific research, and subsequent levels of evolution acceptance. If these participants are the next generation of scholars, there is a necessity to address their preparedness. These needs may be attended to by including aspects of evolutionary educational psychology into the professional education curriculum and by extending opportunities for gaining experience with scientific research. This is critical to assure that in the future there is a cadre of educational professionals who are prepared to continue to evaluate the plausibility and applicability of evolutionary educational psychology or other developments without bias.

We recommend that those individuals with the background and interest in this emerging field examine evolutionary educational psychology to determine its possible relevance and utility for their research programs and potential applications to other fields of study. Further, we encourage scholars who employ the evolutionary educational psychology framework to seek investigation methods that are capable of empirically testing learning and cognition based on this perspective. For example, research that explores the relative ease of learning in biologically primary versus biological secondary domains from an evolutionary educational psychology perspective would be useful to examine this speculated distinction and more fully appreciate the learning implications of the domain differences. In addition, we encourage educators who teach theory courses to include elements of evolution-based explanations for cognition in their curricula so that future scholars can develop awareness of this perspective and be prepared to consider the utility of evolutionary educational psychology in their research programs.

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