

Investigating Nontraditional First-Year Students' Epistemic Curiosity during the Research Process: An Exploratory, Mixed-Methods Study

Michelle Keba Knecht

The purpose of this exploratory, mixed-methods study was to investigate the relationship between nontraditional undergraduate students' curiosity and their experiences researching a topic. The author collected and analyzed survey data and annotated bibliography rubric scores from 59 students at a private, liberal arts university and conducted in-depth interviews to gather a fuller picture of the students' curiosity. Based on the study's findings, librarians and professors should create opportunities for students to select research topics to which they have a personal connection while intentionally offering supportive feedback to students as they refine their topics to reduce anxiety and frustration.

Introduction

Teaching students how to find and evaluate sources for a research paper can be a difficult and demanding task, particularly when the research topic is not of interest to the students. One method for increasing student engagement and academic performance is to cultivate students' curiosity.¹ If curiosity leads to increased student engagement and performance in the academic context, could professors and librarians cultivate students' curiosity to increase their engagement with a research topic? This exploratory, mixed-methods study sought to answer that question by investigating the relationship between students' epistemic curiosity and their experiences selecting and researching a topic.

Epistemic curiosity is "the desire for knowledge that motivates individuals to learn new ideas, eliminate information-gaps, and solve intellectual problems."² This desire for knowledge begins with an information gap that a person seeks to fill. The gap then motivates the person to seek out missing information to reduce feelings of deprivation.³ As individuals attempt to fill their information gap, they can experience a range of emotions. For example, if an individual successfully satisfies their epistemic curiosity through the research process, they can experience positive emotions such as fulfillment and pride. However, the initial stages of searching for information are often associated with negative feelings such as confusion, frustration, and doubt.⁴

*Michelle Keba Knecht is Senior Medical Librarian and Head of the Medical Health Sciences Collection and User Services Department at Charles E. Schmidt College of Medicine, Florida Atlantic University; email: kebam@health.fau.edu. ©2022 Michelle Keba Knecht, Attribution-NonCommercial (<https://creativecommons.org/licenses/by-nc/4.0/>) CC BY-NC.

To avoid confronting the confusion, frustration, and doubt associated with the unknown, students may resort to choosing familiar topics they are comfortable researching rather than diving into new subjects that will spark their curiosity. This may be especially true for students with low information literacy self-efficacy. Self-efficacy is the belief in one's capabilities to accomplish a task,⁵ and information literacy is "the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning."⁶ Beliefs about their information literacy capabilities can affect how resilient students are when faced with difficulties and how likely they are to persevere during the research process.⁷ For this reason, the researcher also considered the students' information literacy self-efficacy levels when investigating the role of epistemic curiosity in the research process.

Literature Review

Most of the recent research on curiosity has been conducted by psychologists attempting to define the boundaries⁸ and types of curiosity including perceptual curiosity,⁹ interpersonal curiosity,¹⁰ epistemic curiosity,¹¹ and performance curiosity.¹² Researchers have also studied the measurement of curiosity as a permanent personality trait versus as a more temporary state, with most assessments of curiosity focusing on curiosity as a trait.¹³

This study focused on epistemic curiosity because it was the type of curiosity most closely related to the intellectual pursuit required by an information search task, and its relationship to student motivation and academic performance has been studied within the context of higher education. In a meta-analytic review of research studies related to intellectual curiosity and academic performance, researchers found not only that students' academic performance might be increased when their intellectual curiosity is cultivated, but also that these students are more likely to enjoy their college experience.¹⁴ A later study confirmed this finding through a grounded theory qualitative approach, noting that "curious students tend to pursue uncertainty, exhibit openness to discovery, and perform better in school."¹⁵

Epistemic curiosity has also been further broken down and studied as a trait composed of two types: deprivation (D-type) and interest (I-type).¹⁶ D-type epistemic curiosity is motivated by the desire to alleviate the discomfort of being deprived of new knowledge, while I-type epistemic curiosity usually arises when there is an interest in gaining new information that is anticipated to bring pleasure.¹⁷ I-type epistemic curiosity typically relates to "openness, preference for novelty, tolerance for ambiguity, and expressions of positive affect,"¹⁸ while D-type epistemic curiosity typically relates to "mastery-achievement, performance-achievement, and failure-avoidance, reflecting concern for the accuracy and usability of new knowledge."¹⁹ The parsing of epistemic curiosity into deprivation and interest types helps to explain the underlying motivations and affective responses students may have as they attempt to satisfy their curiosity.

Curiosity has received minimal yet growing attention within the field of information science. Several authors have written opinion pieces on the importance of incorporating curiosity and creativity into the practice of teaching information literacy skills and have offered suggestions for how to do so.²⁰ However, more research is needed to better understand and measure the effect curiosity has on information literacy capabilities and information literacy self-efficacy. Empirical studies on the topic have offered conflicting observations, with some studies finding that curiosity can be a powerful motivator for students. However, others determined that curiosity could induce feelings of anxiety and avoidance.

Regarding the positive influence of curiosity on the information search process, two studies that focused on the effect of personality dimensions on information behavior found that, among students who were open to experiences, intellectual curiosity encouraged broad information seeking²¹ and that information literacy capabilities and self-efficacy were higher for students who were more curious.²² Similarly, in a recent phenomenological study on how first-year students conduct research, curiosity emerged as a key theme that led to student inquiry and interest in a potential research topic.²³

Alternatively, findings of other studies have focused on the negative emotions associated with curiosity. Using naturalistic research methods to collect data from adolescent students working on a school research project, Bowler found that, “contrary to the expectations of many educators and librarians—for whom curiosity is seen as a good thing—the participants in this study frequently juxtaposed curiosity next to negative feelings, such as nervous, worried, anxious, frustrated, overwhelmed and aggravated.”²⁴ Similarly, in their qualitative study of undergraduate students in a first-year composition course, Rempel and Deitering found that, even when students are curious about a research topic, they will avoid unfamiliar topics to avert the possibility of failure.²⁵ Finally, in a recent study of the affective thresholds of information literacy, Mabee and Francher found that, even when students were researching topics of interest to them, most felt overwhelmed by the research process.²⁶

Information literacy self-efficacy has been measured by a variety of instruments including the Information Literacy Self-Efficacy Scale (ILSES) and the Information Literacy Humanities and Social Sciences Survey (IL-HUMASS).²⁷ These scales are best viewed as additional assessment tools to better understand students rather than as direct predictors of information literacy abilities.²⁸ Though students’ beliefs in their information literacy capabilities can affect their willingness to continue in the face of difficult research and searching situations, research on the Dunning-Kruger Effect has shown that students with low information literacy skills tend to overestimate their abilities.²⁹ While information literacy self-efficacy should not be conflated with information literacy skill level, it can still be considered a contributing factor to students’ perseverance and resilience when engaging in an information search task.

Research Questions

The overall goal of this study was to understand the role epistemic curiosity plays in the research process to inform how research assignments are designed and how topic formulation should be taught. Based on the overall goal, the researcher identified the following three research questions for the study:

RQ1. How do students describe their experiences of epistemic curiosity as they relate to the research process?

RQ2. Do students who score at a high level on the Epistemic Curiosity Questionnaire³⁰ also have a higher self-efficacy level with the research process as rated on the Information Literacy Self-Efficacy Scale³¹ than those who are less epistemically curious?

RQ3. Do students who score at a high level on the Epistemic Curiosity Questionnaire perform better on an annotated bibliography as rated on the Information Literacy VALUE Rubric³² than those who are less epistemically curious?

Methodology

This exploratory study used a concurrent triangulation mixed-methods design to investigate the relationship between epistemic curiosity and the research process. Data sets in concurrent triangulation designs are independent and analyzed separately before being integrated to validate the findings of each method.³³ The researcher chose this design to examine the quantitative relationship among epistemic curiosity, information literacy self-efficacy, and research quality while simultaneously exploring how participants described their experiences with epistemic curiosity during the research process. The qualitative component was included to provide a richer understanding of the statistical analysis and the lived experience of students. This study was approved by the institution's Institutional Review Board.

Participants in this study were enrolled in either the evening or online nontraditional undergraduate program at a private, liberal arts university. These students are typically adult learners (over 26 years old) who take advantage of the 8-week evening and online classes to work full-time during the day. During their first semester of study, the students are required to take a course titled "Academic Research Techniques," which is offered both online and in person. The course focuses on topic development, source selection, and assessment of research material for relevance, credibility, and validity. The Academic Research Techniques course was chosen for this study because it is the students' introduction to the research process in the program, and it is required of all undergraduate students in the evening and online programs. Additionally, the lead professor for the course was supportive of the aims and time commitments required for this study.

The study was composed of a census of all first-year, nontraditional students enrolled in both the online and in-person programs during the Fall A 2018 and Spring A 2019 semesters. In keeping with the university's Institutional Review Board policies, only those students who gave their informed consent were included in the study. Students who chose not to participate in the study were not penalized. The study had a 97 percent participation rate ($N = 59$) and is representative of the first-year, nontraditional students enrolled in the evening and online programs at the university. Demographic characteristics of the participants are reported under the Results section of this study in table 1.

The study used three data collection instruments. First, the study's participants completed a survey via Google Forms composed of demographic questions as well as the Epistemic Curiosity Questionnaire³⁴ and the Information Literacy Self-Efficacy Scale³⁵ to measure their epistemic curiosity and their information literacy self-efficacy. The Epistemic Curiosity Questionnaire is composed of 10 Likert-scale questions designed to measure interest type and deprivation type epistemic curiosity. The Information Literacy Self-Efficacy Scale contains 17 Likert-scale questions designed to measure information literacy self-efficacy. The survey was administered in week 4 of the course after the students received library instruction so participants would have a similar baseline knowledge of information literacy concepts. The librarian who provided the library instruction to the students was not associated with the study to avoid potential bias. Second, students were invited to participate in an in-depth interview in person or remotely during weeks 5, 6, or 7 of the course. Of the 59 participants, 24 chose to participate in an in-depth interview with the researcher. (See appendix for the interview protocol.) Finally, the researcher collected the students' culminating project, which was an annotated bibliography on a research topic of the students' choice and evaluated them using the Association of American Colleges and Universities (AAC&U) Information Literacy VALUE Rubric.³⁶ The Information Literacy

VALUE Rubric contains five rubric rows evaluated across four levels from benchmark at the first level to capstone at the fourth. Using three data collection instruments provided a fuller picture of the students' curiosity, thereby allowing the researcher to observe relationships among multiple sources of data rather than relying solely on one source.

The researcher transcribed, inductively coded, and analyzed the 24 in-depth interviews using applied thematic analysis to identify key themes connected to how students described their feelings of epistemic curiosity as they relate to the research process. Applied thematic analysis involves identifying key themes in the raw qualitative data and then translating them into codes that are assigned definitions to make a codebook.³⁷ At the end of the course, the researcher evaluated the students' annotated bibliographies on the Literacy VALUE Rubric and used linear regression analysis to compare the results of the survey that was given in week 4 to the students' scores on the Information Literacy VALUE rubric. The researcher used Microsoft Excel's Analysis ToolPak add-in to perform the statistical analysis.

Results

Of the students enrolled in the Academic Research Techniques courses, 97 percent chose to participate in and completed the study (N = 59). Demographic information for the participant group is reported in table 1. It should be noted that, while the ratio of males to females is typical for this program, it may not be representative of the broader population; the researcher acknowledges this as a limitation of the study.

Qualitative Results

RQ1: How do students describe their experiences of epistemic curiosity as they relate to the research process?

The first research question in this study seeks to understand how students describe their epistemic curiosity as it relates to the research process. This question was answered through inductive coding and analysis of the in-person interviews. After coding the in-person interviews, three themes emerged from the data. First, participants expressed the importance of a personal connection to their research topic. Second, they spoke about their desire to dig deeper to satisfy their curiosity. Finally, they needed professor guidance to refine their curiosity.

Forging a personal connection to their topic was an overarching theme that was brought up in many of the interviews. Fully 70 percent of the participants mentioned having a personal connection to their research topic in their interviews. This personal connection to their topic increased the students' interest and piqued their curiosity. For example, one participant stated:

"I found the more I researched, the more curious I got as I was unraveling all these different layers. If it was a subject that I wasn't passionate about or personally associated with or if we had been given the research topic and it's not something I could draw any parallels with I think that it would have been a lot harder and obviously my curiosity wouldn't have been as heightened and probably wouldn't have been satisfied."

Age	
18–24 years old	27%
25–34 years old	34%
35–44 years old	22%
45–54 years old	15%
Gender	
Male	30%
Female	70%
Method of Instruction	
Online	46%
In Person	54%

Personal connections were revealed in three distinct manners. Participants felt a personal connection to their topic when it was related to their vocation, their friends and family, or their prior experience. For example, when discussing why she chose her topic, one participant stated, "Because it was something dear to my heart. Like I said I worked in Head Start for one year but since then I've been volunteering because it impacted me, and it was at a point in my life when I was trying to figure out my purpose." Another participant chose her topic because it related to her grandmother. In her interview, she stated, "The one I chose was about cancer and how can being a vegan decrease the probability of cancer. My grandmother died of cancer last year, so it really like interests me to learn about how we can prevent it." Finally, another participant related her topic to her prior experience and current needs. In her interview, the participant stated, "I work with special-needs children at church on the weekend, and it helped. I wanted to learn more about it and how to redirect that behavior, how to help them, how to understand what's going on during those stages and how to help in any way and teach that to the volunteers as well, so it was very interesting, and it was really helpful, and I would definitely continue doing more research on it after this class."

After they had developed a personal connection to their topic, many participants felt the urge to dig deeper to satisfy their curiosity. Just over one-third of the participants mentioned their desire to dig deeper as they learned about their topics. One participant stated, "I just didn't realize how involved researching could be. I never knew that I could dwell all that deep. Although I thought I had been researching deeply, I realized I could take it a step deeper." This desire to dig deeper led students to think critically about their topics and to follow their curiosity out of a sense of genuine interest. For example, one participant said, "After I found a certain article. I was like what? what? I didn't know that! Then I was like not even doing my assignment. I was just reading and not worried about my assignment because it became so interesting to me." Another participant explained, "You have to verify your sources, where it's come from. So critical thinking, it made me look at it more analytically, going in and really digging deeper."

Once participants had identified a personal connection with their topic and dug deeper to satisfy their curiosity, many of them acknowledged that they needed professor guidance to help them refine their curiosity into a thesis statement. A total of 83 percent of the participants mentioned receiving guidance from their professor. For example, one participant stated, "My actual original thesis statement was you know let's talk about the government shutdown. That's what I thought a thesis statement was. That was my question so right off the bat she's like that's not a thesis statement, so I had to be guided on how to formulate a better thesis because I did not understand to be honest." The professor also played a key role as students narrowed down their topics and when they brainstormed ideas for topics. One participant noted, "Since the beginning, I knew what I wanted to talk about, but it was too broad so she kind of helped me narrow it down a little bit" while others mentioned using the professor's suggestions to look for an article of interest via news outlets like the *New York Times* or the BBC.

Quantitative Results

Means and standard deviations for the I- and D-type (interest and deprivation) epistemic curiosity scales, the Information Literacy Self-Efficacy Scale (ILSES), and the AAC&U Information Literacy VALUE Rubric (ILVR) scores are reported in table 2. I- and D-type epistemic curiosity were measured using the Epistemic Curiosity Questionnaire, which rates items on

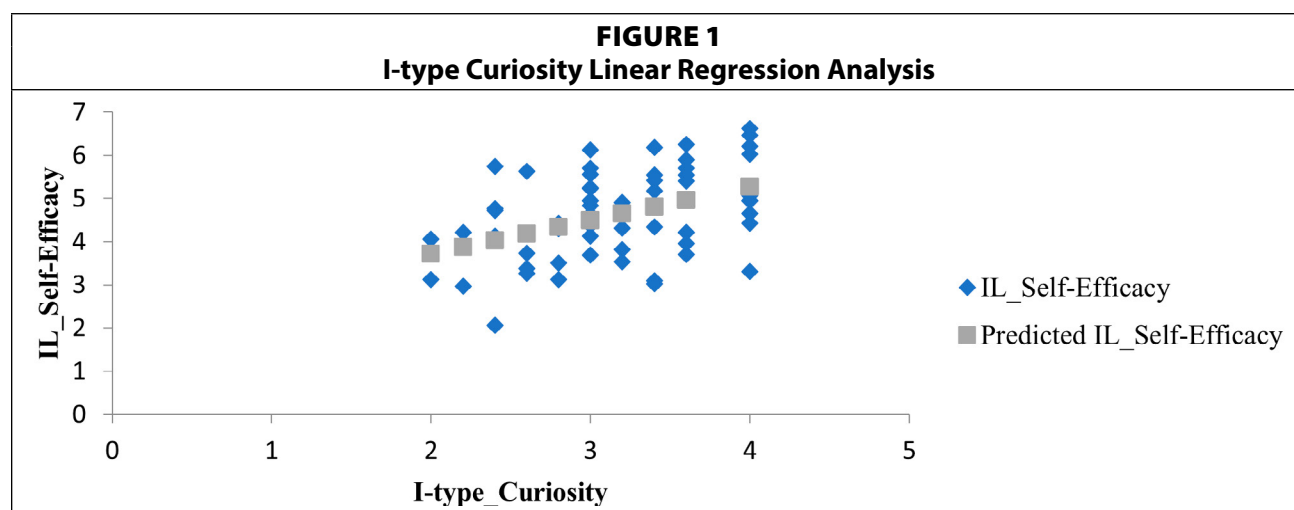
a four-point frequency scale from 1 (*almost never*) to 4 (*almost always*). The Information Literacy Self-Efficacy Scale rates items on a 7-point frequency scale from 1 (*almost never true*) to 7 (*almost always true*), and the AAC&U Information Literacy VALUE Rubric is composed of four performance levels from 1 (*benchmark*) to 4 (*capstone*).

	Mean	(SD)
I-type Epistemic Curiosity	3.17	(0.57)
D-type Epistemic Curiosity	2.43	(0.63)
ILSES	4.63	(1.04)
ILVR	2.33	(0.43)

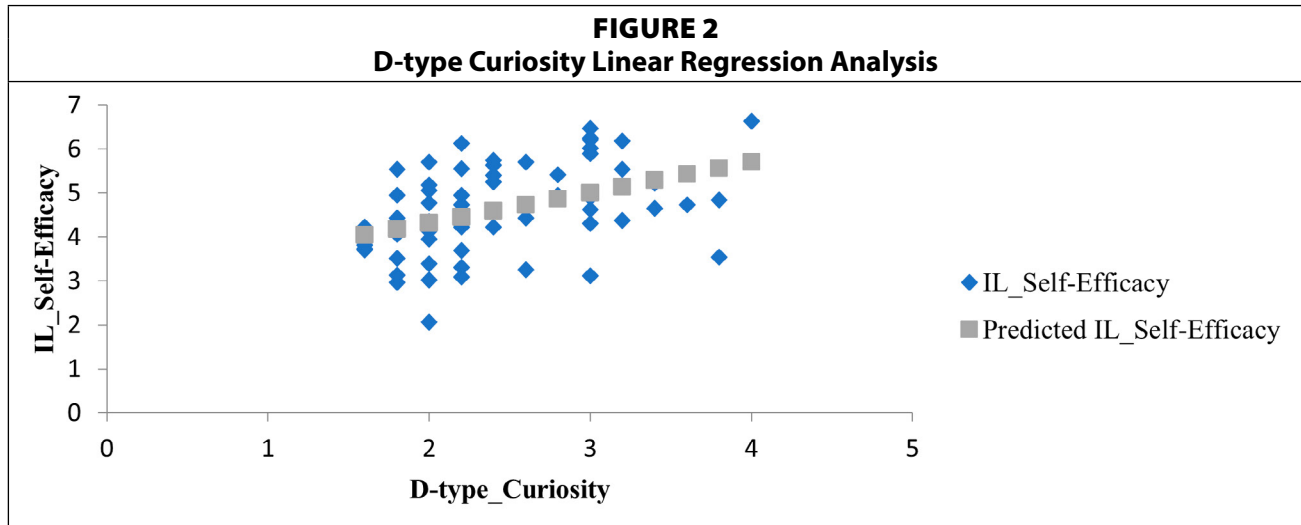
RQ2: Do students who score at a high level on the Epistemic Curiosity Questionnaire also have a higher self-efficacy level with the research process as rated on the Information Literacy Self-Efficacy Scale than those who are less epistemically curious?

The second research question in this study seeks to understand the quantitative relationship between the students' epistemic curiosity and their information literacy self-efficacy. This question was answered through a statistical analysis of the survey students completed at the beginning of the study. The survey included the Epistemic Curiosity Questionnaire, which measures both interest type and deprivation type curiosity, and the Information Literacy Self-Efficacy Scale, which measures information literacy self-efficacy.

To answer research question 2, linear regression analysis was used to investigate whether the students' I-type and D-type epistemic curiosity could be used to predict their information literacy self-efficacy. Microsoft Excel's Analysis ToolPak add-in was used to run a linear regression analysis to predict if there was a linear predictive relationship between curiosity and information literacy self-efficacy. For I-type epistemic curiosity, the linear regression was statistically significant at $p < .01$ and the R^2 was 0.18. In other words, I-type epistemic curiosity could explain about 18 percent of the variation in the dependent variable, information literacy self-efficacy. A graphical representation of the regression line as related to the cluster of scores for I-type epistemic curiosity and information literacy self-efficacy shows the linear predictive relationship between the two variables in figure 1.



For D-type epistemic curiosity, the linear regression was statistically significant at $p < .01$ and the R^2 was 0.17. In this case, D-type epistemic curiosity could explain about 17 percent of the variation in the dependent variable, information literacy self-efficacy. A graphical representation of the regression line as related to the cluster of scores for D-type epistemic curiosity and information literacy self-efficacy shows the linear predictive relationship between the two variables in figure 2.



RQ3: Do students who score higher on the Epistemic Curiosity Questionnaire perform better on an annotated bibliography as rated on the Information Literacy VALUE Rubric than those who are less epistemically curious?

The third research question in this study seeks to understand the quantitative relationship between the students' epistemic curiosity and their score on the annotated bibliography they created as the culminating assignment of the course. This question was answered through statistical analysis of the students' responses to the Epistemic Curiosity Questionnaire and their scores on their annotated bibliography as rated by the researcher on the Information Literacy VALUE Rubric. To answer research question 3, linear regression analysis was used to investigate whether the students' epistemic curiosity (I-type and D-type) could be used to predict their scores on the Information Literacy VALUE Rubric. The linear regression of these variables was not statistically significant. The p -value for I-type curiosity was 0.76 and the p -value for D-type curiosity was 0.24. It is possible that the sample size ($N = 59$) was too small or that there was no correlation between the two variables.

Discussion

This study attempted to investigate the relationship between students' epistemic curiosity and their experiences selecting and researching a topic to determine how research assignments should be designed and how topic formulation should be taught. Through qualitative and quantitative analysis of the data, the researcher found that personal connection to a topic plays a key role in motivating students to dig deeper into a research topic and that those feelings of curiosity should be encouraged and cultivated through professor support and guidance.

These findings are in line with prior research on the topic. Similar to the results of this study, in a recent phenomenological study of first-year students, researchers found that ob-

taining relevant sources sparked students' curiosity and encouraged them to dig deeper to continue their research.³⁸ In another recent study, researchers found that students were excited and passionate about topics that were relevant to their lives and that they were better able to establish a work/life balance when they chose a topic to which they had a personal connection.³⁹ Though the students were excited about their topics, feelings of anxiety and frustration were still apparent as they searched. The participants in this study referred to similar feelings of frustration especially when crafting the thesis statement for their annotated bibliography, but in this study the professor's guidance and support helped to alleviate those feelings.

Implications and Limitations

Regarding *RQ1*, the researcher suggests that librarians and teaching faculty work together to design assignments and activities that will encourage students to choose research topics about which they are curious and to which they have a personal connection. However, the professor and/or librarians should intentionally plan how they intend to actively support and guide the students as they narrow and refine their topic into a researchable thesis statement.

While it is outside the scope of this study to describe and create specific activities to cultivate and guide curiosity, other authors have included suggestions in their articles. For example, when introducing students to a research project, Rempel and Deitering recommend carefully considering the terms you will use. They suggest using phrases like "learning" about a topic and for students to choose something they are "curious" about rather than "finding sources" and selecting something about which they are "passionate." They also recommend developing activities that will allow students to explore their curiosity in a curated manner such as by reviewing press releases on the university's research channel and encouraging students to spend time reflecting on their curiosity.⁴⁰

For *RQ2*, the researcher recommends that future research continue to investigate the relationship between epistemic curiosity and information literacy self-efficacy. The results of this study imply that there is a statistically significant relationship between epistemic curiosity and information literacy self-efficacy. However, future research should focus on how epistemic curiosity and information literacy self-efficacy interact as students work on a research project and what role they play in students' willingness to persevere and dig deeper as they research a topic. Future studies should also be expanded to include additional student populations including traditional undergraduate and graduate students.

In response to *RQ3*, further research needs to be conducted on the relationship between epistemic curiosity and the quality of student research assignments. Though there was not a statistically significant relationship between epistemic curiosity and the students' scores on the Information Literacy VALUE Rubric in this study, it is possible that the sample size ($N = 59$) was too small to achieve statistical significance. Future studies should include a larger sample size and additional co-researchers so that the rubric scores can be normed and so that inter-rater reliability can be calculated. Additionally, future research should attempt to study epistemic curiosity as a state related to the choice of research topic rather than as a fixed trait and should evaluate the effect of curiosity-building exercises on student engagement with research projects and papers.

Conclusion

This study offers the first exploration of the role epistemic curiosity plays in the research pro-

cess specifically for nontraditional undergraduate students. The results should be considered when professors and librarians design research assignments and decide how topic formulation should be taught. Based on the findings of this study, librarians and professors should create opportunities for students to select research topics to which they have a personal connection to pique the students' curiosity and encourage them to dig deeper into the research on their topic. However, to avoid feelings of anxiety and frustration associated with the early stages of the search process, professors and librarians should design opportunities for students to engage with a variety of researchable topics about which they may be curious and should give students feedback and support as they refine and narrow their topics. By cultivating curiosity while guiding and supporting, professors and librarians can engage students in the research process.

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APPENDIX. In-Depth Interview Guide

Hello, my name is Michelle, and I'm a librarian here at the university. Thank you for volunteering to participate in this interview. The purpose of this study is to understand the role curiosity plays in the research process. During the interview, I will ask you a few questions about your experience researching for the annotated bibliography assignment in your Academic Research Techniques Course. Your participation is completely voluntary, and you can stop the interview at any time. I'd like to record our time together just so I can refer back to it later, for accuracy. Is it okay with you if I record this? [Include guidelines for discussion and information about informed consent and confidentiality from your university here.] Finally, do you have any questions before we begin?

1. Let's get started by talking about the research process. By research, I mean independent work or a class assignment. **Can you tell me about a time when you had to write a research paper prior to this class?** (*Descriptive*)
2. **What's the most interesting research project you've ever had?** (*Descriptive*) Possible probe: *What made it interesting?*
3. Ok; thank you for the information about your prior experience. Now we're going to shift to what's happening in your class right now. **Think back to when you first selected the topic for your annotated bibliography in this class; what topic did you choose and how did you choose your research topic?** (*Descriptive*)
4. **What did you know about this topic before you selected it?** (*Perception*)
5. Thank you for your responses. Let's now move to the next section of the interview and discuss curiosity. **How would you define curiosity in your own words?** *Clarification: if they ask what I mean by curious, use the alternate term "interested in" to clarify.*
6. **According to the definition that you just gave me, what aspects of your research topic were you curious about?** (*Perception*) Possible probes: *If they can identify aspects they were curious about, ask, Have you always been curious about this topic? If they say they were not curious about the topic, have them identify at least one thing they are curious about; ask, Even if you weren't curious initially, was there anything that emerged that piqued your interest? Who or what could've made your response different? Is there anyone you could've talked to more about this inside or outside the classroom?*
7. **At what point in the process did you begin feeling that curiosity?** (*Descriptive*) Possible probes: *Why was it then and there? What was going on in your head?*
8. **How did your curiosity about this topic affect your feelings while researching?** (*Perception*) Possible probes: *How do you feel about research or how do you feel about yourself as a researcher?*
9. **Is there anything we haven't touched on about curiosity or your research topic that you would like to tell me?** (*Closing*) Possible probes: *What insight could you share with me that I didn't touch upon? What can you open my eyes to about researching as a student?*

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