

The Influence of Demographic Factors in Shaping Epistemological Beliefs among Prospective Teachers

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Abstract

This study explored the structural relationships between demographic variables (semester of study, residence, gender, and CGPA) and epistemological belief constructs (talent and effort) among prospective teachers. A sample of 330 prospective teachers was taken by using stratified sampling technique. The findings through subgroup analyses using independent sample t-tests and ANOVA revealed significant differences in epistemological beliefs based on semester progression, residence, and academic performance, supporting the impact of demographic and academic variables. This study contributes to the growing body of literature on epistemological beliefs by integrating socio-cultural and academic factors into the analysis of prospective teachers' learning perceptions. These insights are particularly valuable for teacher education programs, because they highlight the role of demographic characteristics in shaping students' epistemological beliefs.

Keywords: *Epistemological beliefs, effort, talent, demographic factors, prospective teachers*

Background of the Study

According to Hofer and Pintrich (1997) and Schommer (1990), epistemological beliefs are people's views on the nature of knowledge and the procedures involved in obtaining and verifying it. The way people approach learning, view their own skills, and participate in academic activities are all significantly influenced by these beliefs (Ventista & Brown, 2023). Furthermore, these beliefs affect cognitive functions like information processing, problem-solving, and critical thinking, all of which directly affect a learner's academic performance and results (Hyytinen et al., 2014; Anders, et al., 2018; Zlatkin-Troitschanskaia, et al, 2020). Since epistemological beliefs have broad ramifications, they are naturally multifaceted, with various facets of these beliefs impacting behavior in a variety of academic and professional situations (Barzilai & Weinstock, 2015).

Schommer (1990) introduced a multifaceted framework for understanding epistemological views in her groundbreaking work. This framework included essential elements like the nature of knowledge, the process of knowing, and the source of information. This framework's views regarding the source of knowledge; more especially, whether knowledge is viewed as fixed or malleable; are a crucial component (Biçer & Yıldırım, 2023; Demirbag & Bachivan, 2021; Gholami, Alikhani & Tirri, 2022). Yousefi and Khalkhali (2020) proposed that epistemological beliefs can be categorized into two primary constructs: talent, which reflects the idea that knowledge is based on natural aptitude, and effort, which sees knowledge as the result of persistent work and persistence. This difference has a big impact on how people feel about problems and learning (Yağan & Parlar, 2023).

According to Mahmood, Khan, and Ahmad (2020), epistemological beliefs are especially important for aspiring teachers because they affect how they approach their own professional development and learning as well as how they interact with their future pupils. For example, a study by Kutluca and Mercan (2022) discovered that instructors' pedagogical strategies, classroom management techniques, and approaches to assessment and instruction are significantly influenced by their views about the nature of knowledge and the processes of knowing. Likewise, According to Madiha and Alibakhsi (2020), teachers' epistemological ideas are crucial in determining how they teach. Teachers who believe that knowledge is fixed and based on talent tend to favor more teacher-centered, didactic techniques. On the other hand, people who think that knowledge is earned through hard work are more likely to use inquiry-

based, student-centered teaching strategies that prioritize active engagement with the content, critical thinking, and problem-solving.

It is essential that teacher education programs specifically address epistemic cognition since epistemological views have a significant influence on instructional practices (Soleimani, 2020). Inquiry-based learning experiences, reflective practices, and conversations on the nature of knowledge are all crucial components of teacher preparation programs (Richardson, 2003; Voet & De Wever, 2019). Furthermore, numerous studies indicated that specific interventions, like exposure to constructivist learning models and metacognitive training, can assist aspiring educators in forming more complex epistemological beliefs (Chai et al., 2011; Cetin-Dindar & Kirbulut 2014; Mete, 2024). According to Greene, Muis, and Pieschl (2010), epistemological convictions influence future educators' professional identities as well as how they approach learning. Education programs can better prepare aspiring educators to engage students in meaningful, inquiry-driven learning experiences by including epistemological views into teacher training (Lunn Brownlee et al., 2017; Bendixen & Rule, 2004; Kuhl, 2024). It is possible for aspiring educators to cultivate more complex and adaptable epistemological views through the use of varied teaching methods, reflection exercises, and group discussions (Schraw & Olafson, 2003; Hofer, 2004; Aguilar-Valdés, 2024).

The development of epistemological beliefs has long been found to be influenced by demographic factors, including age, gender, academic performance as measured by CGPA (Liang, Ren & Shi, 2023; Tong et al., 2024; Mohamed 2024), and cultural background as measured by whether a person lives in an urban or rural area (Alkış Küçükaydın, et al, 2024). such as how people view their own competencies, the nature of knowledge, and their method of learning (Sulimma, 2009; Shultz, 2022). Epistemological beliefs are shaped by external factors such as socialization processes, cultural contexts (residence), and educational experiences (semester progression), as has been repeatedly discussed in a body of literature (Ali et al., 2021; Buehl & Fives, 2016). Essentially, a large body of research has shed light on how demographic characteristics influence the development of epistemological beliefs and how those beliefs affect learning outcomes and behaviors (Klop & Stark, 2022; Schiefer et al., 2022; Klop, Krause & Stark, 2023).

For instance, Shoaib, Naheed & Nasreen, (2021) discovered that female students were more likely than male students to adopt flexible, nuanced epistemological beliefs, which enabled them to approach academic activities with higher levels of cognitive involvement. According to Kurt (2009), these disparities may be explained by socialization processes, gendered educational expectations, and deeply ingrained cultural ideas that influence how each gender perceives knowledge and how it is acquired. According to Er (2013), women may be more likely to be socialized to value perseverance and effort in learning, which could result in more adaptive academic behaviors and a greater propensity to see knowledge as developing via effort rather than being fixed and dictated by innate capability.

Furthermore, Lonka, Ketonen, and Vermunt (2021) investigated the relationship between academic achievement, as determined by CGPA, and the sophistication of epistemological beliefs, finding that students who perform better had more sophisticated views on the nature of knowing. While lower-performing students could struggle with dualistic or fixed epistemological beliefs, which prevent them from engaging in deep, meaningful learning, these students typically see knowledge acquisition as a changing, effort-based process (Yağan & Parlar, 2023). Likewise, recent studies have also elucidated the development of epistemological beliefs and their relationship with academic progression (semester in which they are studying) and contextual factors (area of residence). Research by Demirbag and Bahcivan (2021) found that sophisticated epistemological beliefs positively predicted argumentation skills, suggesting that individuals with more advanced beliefs about the nature of knowledge are more likely to engage in constructive arguments. Additionally, self-regulation skills such as goal setting and

asking questions positively predicted participation in argumentation. This indicates that students who are better at regulating their learning processes are more likely to engage in meaningful academic discussions. Similarly, a study by Ongowo (2021) examined the influence of grade level on the development of science epistemological beliefs among secondary school students in Kenya. The findings indicated that as students advanced in their studies, their epistemological beliefs evolved, becoming more sophisticated and reflective of a deeper understanding of scientific knowledge.

Furthermore, in the context of prospective teachers in South Asia, there is a noticeable gap in research regarding how demographic factors influence the constructs of talent and effort in relation to epistemological beliefs. Most existing studies on this topic have been conducted in Western contexts (Kaya, 2017; Trautwein & Lüdtke, 2009; Chang, 2024; Lonka, Ketonen & Vermunt 2021; Ercolani, Evans & Davies 2023) where the educational systems and cultural dynamics differ significantly from those in South Asia. Consequently, there is limited research examining how cultural factors (area of residence) unique to South Asia shape these beliefs.

This study aims to fill this gap by exploring how demographic variables such as semester of study (semester progression), residence (urban vs. rural), gender (male vs. female), and academic performance (CGPA) influence the epistemological beliefs of prospective teachers at one of the pioneer Institute of Education and Research (IER), Punjab University, Lahore, Pakistan.

Theoretical Perspectives

The theoretical framework guided this study was anchored in Schommer's Epistemological Beliefs Theory (1990), which conceptualizes epistemological beliefs as multidimensional constructs that evolve along a continuum, from naive to more sophisticated understandings of knowledge and learning. Central to this study are the constructs of talent and effort, which are pivotal in understanding how prospective teachers perceive the nature of knowledge acquisition and the extent to which they believe success is driven by inherent ability (talent) versus perseverance (effort) (Letina, 2022).

Within this framework, demographic variables specifically gender, semester of study, residence (urban vs. rural), and academic performance (CGPA) are considered as potential predictors of these constructs of epistemological beliefs. These demographic factors influence how prospective teachers construct their beliefs about the sources of knowledge, how they perceive their own learning abilities, and how they engage with educational challenges (Gholami, Alikhani & Tirri, 2022; Ali, Bakar & Nasim, 2021). By investigating these factors, this study aims to explore the complex relationships between demographic characteristics and epistemological beliefs, providing a nuanced understanding of how these beliefs shape teaching behaviors and academic outcomes.

Literature Review

Epistemological Beliefs

The study of epistemic beliefs (EB), or views about knowledge and learning, is sometimes confused with philosophy. According to Brownlee, Schraw, and Berthelsen (2011), Schommer created a multidimensional model of epistemological perspectives in 1990. The dimensions of her EB model are as follows: (1) beliefs regarding the source of knowledge; (2) beliefs regarding the certainty of knowledge; (3) beliefs regarding the structure of knowledge; (4) beliefs regarding the speed of learning; and (5) beliefs regarding the stability of knowledge. Furthermore, she distinguishes a number of aspects of these beliefs, such as the source of information, which includes concepts like natural aptitude vs learned effort (Soleimani, 2020). The constructs of talent and effort are particularly pertinent in educational contexts, as they influence how individuals approach challenges, persist in tasks, and perceive their abilities

(Dweck, 2006; Evans, Ercolani & Davies, 2023). Talent reflects a belief in fixed abilities, while effort emphasizes the role of hard work and perseverance in achieving success (Lin, 2021).

Research studies suggested that the students who have developed sophisticated EB use numerous and more qualified cognitive knowledge processing strategies. These students show more academic success, have more academic attitudes to school, believe in the usefulness of education more, and construct more complex, deep, and sophisticated opinions (Cano, 2005; Sengul, 2024). The tendency in education regarding beliefs is to evaluate beliefs as factors conduct behaviors (Biçer & Yıldırım, 2023).

From the perspective of prospective teachers, by having teachers with more sophisticated EB, teachers can be better equipped to improve their professional development, and more effective learning environments can be prepared for their students (Kurnaz, 2022; Fowler, Gabriel & Leonard, 2022). For instance, a study conducted by Akkuş, Cevger & Küçük-Turgut (2023) examined the locus of control and epistemological beliefs of prospective teachers. Their findings indicated that individuals who believed that learning is driven by effort rather than innate ability tended to develop more sophisticated epistemological beliefs, suggesting that emphasizing the role of effort in learning can enhance students' understanding of knowledge and knowing.

Demographic Factors and Epistemological Beliefs

Academic Progression (Semester Studied)

Academic advancement has a significant impact on how potential teachers build their epistemological views, with more complex ideas generally emerging in later semesters (Klopp & Stark, 2023). Future educators encounter more challenging coursework, teaching practicums, and real-world experiences as they advance through their programs, which give them the chance to reevaluate and strengthen their preconceived notions (Sengul, 2024). Advanced coursework and teaching practicums have a significant impact on the development of epistemological ideas, according to Brownlee et al. (2011). Since they encounter more complex educational theories, pedagogical techniques, and the realities of classroom teaching as they progress through their programs, aspiring teachers are prompted to reevaluate their oversimplified conceptions of knowledge (Tong et al., 2024; Biçer & Yıldırım, 2023). The transition from dualistic thinking, which views information as absolute, to more complex constructivist viewpoints that highlight how knowledge is dynamic and ever-evolving is frequently indicative of this evolution (Hofer & Pintrich, 1997; Schommer, 1994; Sengul et al., 2024). According to research, this change is largely caused by exposure to a variety of teaching philosophies and teaching experience reflection (Bromme et al., 2010; Chinn et al., 2011; Acar, 2022; Tenenberg & Chinn, 2024).

Residence (Urban vs. Rural)

The sociocultural context, which includes elements like geographic location, is crucial in forming students' epistemological views, especially when it comes to the distinctions between urban and rural settings (Ananda, 2020; Gong, Niu & Wang 2020). Because they are exposed to a wider range of viewpoints and experiences, urban educators may form more complex epistemological beliefs (Tong, 2024; Lu, 2024). Furthermore, it has been proposed by Karakus and Savas (2012) that urban teachers are more likely to encounter a range of cultural, intellectual, and educational viewpoints, which could lead to the formation of more complex ideas regarding the nature of knowledge.

Teachers may become more accepting of the notion that knowledge is flexible and prone to change in urban environments, where there is usually better access to a variety of educational resources and professional development opportunities (Tanase & Wang, 2010; Shen, et al., 2023). An epistemological position known as constructivism, in which knowledge is viewed as developing by social interaction, is fostered by exposure to many educational philosophies, varied student populations, and interdisciplinary collaborations (Lunn Brownlee et al., 2016). Additionally, urban teachers often engage in new educational innovations and professional

learning groups, which further strengthens epistemic flexibility (Alexander, Buehl & Murphy, 2002; Alkış Küçükaydın, et al., 2024).

Conversely, instructors in rural areas could encounter more conventional learning environments with fewer resources, opportunities for professional growth, and exposure to novel concepts (Tondeur et al., 2018; Dong et al., 2019; Hou & Li, 2022). This may lead to more dualistic or inflexible views of knowledge as unchangeable and final. According to this viewpoint, research by Aguilar-Valdés et al. (2024) has shown that teachers in rural areas frequently have fewer possibilities to interact with a variety of pedagogical theories and practices, which can hinder the formation of more sophisticated epistemological views. The survival of absolutist or authority-dependent knowledge systems may be attributed to a lack of exposure to different points of view (Lumpe et al., 2000; Odebiyi & Choi, 2020; McCoy & Lynam, 2022; Koul & Bansal, 2023).

Gender

Research on gender disparities in epistemological views has been ongoing, with studies showing that gender can affect how people view the nature of knowledge. According to recent research by Shirzad et al. (2022), female students typically have more complex and relativistic epistemological ideas than their male counterparts. Furthermore, women frequently exhibit higher levels of metacognitive awareness and a larger propensity for open-ended inquiry, which helps them create more complex epistemological views (Muis et al., 2006; Kurt, 2009; Alkış Küçükaydın, et al., 2024)..

Academic Performance (CGPA)

Another significant element affecting the complexity of epistemic views is academic achievement. Students' epistemological ideas are significantly influenced by their academic success, which is frequently gauged by their Cumulative Grade Point Average (CGPA) (Muis et al., 2018). Higher achievers typically have more sophisticated views on knowledge and learning, especially when it comes to effort, perseverance, and cognitive flexibility, according to a wealth of research. Higher CGPA students are more likely to see information as changing via active engagement rather than as static and unalterable, and they are more likely to understand the value of hard work and persistence in conquering obstacles (Cano, 2005; Muis, 2007; Yough, Tan, Fedesco & Cho, 2022). Additionally, a growth-oriented attitude, which emphasizes the importance of effort in the learning process, is frequently adopted by high-achieving students (Dweck, 2006; Burnette et al., 2013). Additionally, they are more likely to use self-regulated learning techniques that support the idea that knowledge is created rather than passively acquired, like metacognitive monitoring and adaptive problem-solving (Pintrich, 2002; Greene & Azevedo, 2007; Ali, Haider & Munawar 2020; Uslu & Durak, 2022).

Conversely, students with lower academic performance may be more likely to hold dualistic or fixed beliefs about knowledge, viewing learning as either something one “naturally” succeeds at or fails in, and attributing success to inherent talent rather than sustained effort (Schommer, 1990; Bråten & Strømsø, 2006). This perspective aligns with entity theories of intelligence (Dweck, 2006), in which students perceive intelligence as static rather than malleable. Hofer and Pintrich (1997) also founded that students with lower achievement levels are more likely to endorse absolutist views of knowledge, believing that answers are either right or wrong, rather than recognizing the complexity and evolving nature of knowledge.

Objective:

1. To explore the influence of demographic variables (semester, residence, gender, CGPA) on epistemological belief of prospective teachers.

Hypothesis:

H01: There is no significant difference in the constructs of talent and effort (epistemological beliefs) based on semester progression, residence, gender, or academic performance (CGPA).

Methods

Research Design

This study employed a quantitative, cross-sectional survey research design. A cross-sectional design is particularly effective in capturing variations across different subgroups within a population, allowing for comparisons between groups based on their academic progression, learning environments, and cognitive beliefs (Creswell & Creswell, 2018).

Population, Sample and Sampling Technique

The target population for this study comprised prospective teachers enrolled in the teacher education programs at one of the pioneer Institute of Education and Research (IER), Punjab University, Lahore. A total of 330 prospective teachers participated in the study

Instrument

The Schommer Epistemological Beliefs Questionnaire (SEBQ) developed by Schommer-Aikins (2004) was adapted to collect the data on epistemological beliefs of prospective teachers. This Likert type questionnaire was comprised of 33 items, with distinct 2 constructs, talent and effort in understanding epistemological beliefs of individuals. The talent construct represents beliefs about knowledge as a fixed, innate ability ranging from item number 1-16 in the main scale, while the effort construct highlights the role of perseverance and hard work in the acquisition of knowledge ranging from item numbers 17-33 in the main scale. The systematic instrument adaptation process ensured the Schommer Epistemological Beliefs Questionnaire (SEBQ) contextually relevance for Pakistani prospective teachers.

Reliability

The SEBQ has shown potential reliability, with Cronbach's alpha values ranging for talent construct 0.74 and effort construct 0.79 (Schommer, 1990). The Cronbach's alpha value of our study is 0.968.

Validity

The construct validity of the SEBQ has been well-established through factor analysis, which supports the instrument's ability to accurately measure the intended constructs of epistemological beliefs (Hofer & Pintrich, 1997).

Data Collection

Data for this study were systematically gathered through a structured survey administered to prospective teachers enrolled at the Institute of Education and Research (IER), Punjab University, Lahore. The survey was divided into two key sections. The first section gathered demographic data, including participants' semester of study, residence (urban vs. rural), gender, and Cumulative Grade Point Average (CGPA). These demographic variables were selected based on existing literature suggesting their potential influence on epistemological beliefs (Schommer, 1990; Karakus & Savas, 2012). By incorporating these factors, the study aimed to explore their relationships with the two primary constructs of talent and effort as identified in the theoretical framework.

The second section of the survey consisted of the SEBQ, a validated instrument designed to assess the respondents' beliefs about the nature of knowledge. Specifically, the SEBQ measures the constructs of talent (knowledge as a fixed attribute) and effort (knowledge as the result of effort and persistence). This instrument was administered to collect comprehensive data on prospective teachers' views regarding their own learning processes and knowledge acquisition. The survey was distributed in a controlled, classroom environment, providing consistency across participants and minimizing potential distractions. The administration time for the survey ranged between 20 to 30 minutes, with ample opportunity for students to respond thoughtfully (Redlich-Amirav & Higginbottom, 2014). The structured nature of the survey minimized the possibility of researcher bias and ensured the collection of systematic, quantifiable data. Additionally, the survey was designed to be user-friendly to accommodate participants from diverse backgrounds and levels of academic experience.

Data Analysis

Inferential Statistics

Inferential statistics were used to summarize the demographic variables (semester of study, residence, gender, CGPA) and the constructs of talent and effort. Levene's Test confirmed homogeneity of variance. Furthermore, linearity was examined to verify that continuous variables exhibited a linear relationship, particularly relevant for regression analysis and factorial ANOVA

Results

To address hypothesis "There is no significant difference in the constructs of talent and effort (epistemological beliefs) based on semester progression, residence, gender, or academic performance (CGPA), independent sample t-tests and one-way ANOVA were conducted to analyze variations across these demographic and EB factors.

The results of the independent samples t-tests revealed significant differences in the constructs of talent and effort between males and females across all three measures. For the first construct, females ($M = 70.23$) scored significantly higher than males ($M = 42.22$). Similarly, for the second construct, females ($M = 75.48$) also outperformed males ($M = 48.25$). Lastly, for the overall constructs, females ($M = 145.715$) achieved significantly higher scores than males ($M = 90.48$).

The results of the independent samples t-tests indicated significant differences in the constructs of talent and effort between urban and rural students across all three measures. For the first construct, rural students ($M = 128.15$) scored significantly higher than urban students ($M = 69.508$). In the second construct, urban students ($M = 74.83$) outperformed rural students ($M = 47.95$). For the third construct, urban students ($M = 144.33$) scored significantly higher than rural students ($M = 89.94$).

The univariate analysis of variance (ANOVA) results revealed significant differences in the perception of epistemological beliefs among prospective teachers across different semesters. The between-group variability is substantial, with a mean square of 50283.469 compared to 484.625 for within-group variability. The F-statistic of 103.75 is highly significant indicating that the semester progression significantly influences the perception of epistemological beliefs. These results suggested that perceptions vary meaningfully across the groups, necessitating a post-hoc analysis to identify specific differences between semesters.

The univariate analysis of variance (ANOVA) results showed significant differences in prospective teachers' perceptions of both constructs of epistemological belief among CGPA groups. The between-group variability (Mean Square = 17,833.186) was much larger than the within-group variability (Mean Square = 835.387), resulting in a highly significant F-statistic. post-hoc comparisons results using the LSD test revealed significant differences among all CGPA group comparisons. The largest mean difference was found between the 1.5–2.9 CGPA group and the 3.6–4.0 CGPA group, indicating a substantial increase in epistemological belief constructs among students with higher CGPAs. Similarly, significant differences were noted between the 1.5–2.9 and 3.0–3.5 groups and the 3.0–3.5 and 3.6–4.0 groups, demonstrating a progressive enhancement in perceptions of these constructs as CGPA increased.

Discussion

The findings of this study provided valuable insights into how demographic factors such as semester progression, residence, gender, and academic performance (CGPA) shape the epistemological beliefs of prospective teachers, particularly in relation to talent and effort. The independent sample t-tests and ANOVA results demonstrated significant differences in epistemological beliefs based on semester, gender, and residence. Senior students (higher semesters) exhibited more sophisticated beliefs about effort as a determinant of success, who

argued that advanced coursework and practicum experiences contribute to more flexible epistemological perspectives (Sengul, 2024; Tong et al., 2024; Biçer & Yıldırım, 2023). Additionally, the gender differences identified in this study echoed findings from Bromme et al. (2010), showing that males tend to maintain absolutist views while females gradually develop constructivist beliefs.

However, CGPA did not exhibit as strong of an influence as expected, which partially contradicts previous research stating that higher academic performance correlates with more advanced epistemological beliefs (Muis et al., 2020). One possible explanation is that CGPA alone may not capture deeper cognitive and metacognitive engagement, as epistemological beliefs also depend on external educational experiences beyond grades (Demirbag & Bahcivan, 2021).

Conclusion

This study investigated statistical relationships between demographic variables (semester, residence, gender, and CGPA) and epistemological beliefs, specifically the constructs of talent and effort, among prospective teachers. The results indicated that gender and residence were significant predictors of students' perceptions of talent, with gender showing a stronger positive correlation and residence revealing notable disparities between urban and rural students. Semester progression (academic experience) and CGPA were found to have a more pronounced effect on shaping effort-based beliefs, suggesting that as students advance in their programs, they are more likely to recognize the role of persistence and hard work in academic success. These findings underscore the complex interplay between demographic factors and epistemological beliefs, offering valuable insights into how prospective teacher's perceptions of knowledge acquisition are shaped by their demographic variables (gender, residence, semester, CGPA).

Delimitations of the Study

Despite the valuable insights gained from this study, several limitations should be acknowledged. First, the study relied on self-reported data, which may be subject to social desirability bias or misinterpretation of survey items by participants. Future research could incorporate qualitative methods such as interviews or observational studies to triangulate findings and provide deeper insights into epistemological beliefs.

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ISSN Online : 2709-4030

ISSN Print : 2709-4022

Vol.8 No.2 2024

Contradictory Sources of Information in Performance Assessments. *Front Psychol.*
doi: 10.3389/fpsyg.2020.02192. PMID: 33013566; PMCID: PMC7516056.