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## The Role of Epistemic Beliefs and Gender in Online Argumentative Essay Writing

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**Abstract:** This study explores the role of students' epistemic beliefs and gender in argumentation performance in essay writing within an online learning environment. In this exploratory study, data were collected from 148 undergraduate students from a Dutch university specializing in life sciences. In this study, both male and female students were asked to follow an argumentative essay writing module for three weeks. In the first week, students write an essay on given topics. In the second week, students provided peer feedback and in the third week, students revised their essays based on the received feedback from peers. In the end, students filled out a survey about epistemic beliefs. The results showed that students' beliefs about the Internet-specific justification of knowledge did not influence argumentation performance, while beliefs about the nature of scientific knowledge had an influential role. Results showed no overall gender differences in argumentative essay writing. The interaction effects of beliefs about the Internet-specific justification of knowledge and gender in argumentation performance, overall, were reported to be neutral. However, there was an interaction effect between students' epistemic beliefs about the nature of scientific knowledge and their gender in argumentation performance. These findings provide evidence for guiding students' argumentation performance in higher education.

**Keywords:** Argumentation; Epistemic Beliefs; Essay Writing; Gender; Online Learning

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## Introduction

Online learning is an important part of education in the post-Covid era (Banihashem et al., 2023b; Hassanzadeh et al., 2016; Gholami et al., 2021; Stevens et al., 2023; van Puffelen et al., 2022). In the post-Covid education, writing an argumentative essay is the most common genre of writing in higher education (Latif et al., 2021; Kerman et al., 2023; Noroozi et al., 2012; 2023; Vale Haro et al., 2023). Scientific evidence suggests that some factors can influence students' argumentation competence in essay writing such as their beliefs about the nature of knowledge (Baytelman et al., 2020; Noroozi, 2018; Noroozi & Hatami, 2019) and their gender (Asterhan et al., 2012; Banihashem et al., 2023a; Kerman et al., 2022; Noroozi et al., 2020, 2022). Epistemic beliefs generally refer to one's beliefs about the nature and structure of knowledge (Hofer & Pintrich, 1997). In the context of education, epistemic beliefs explain how students approach education and learning (Muis et al., 2006). According to the literature, epistemic beliefs entail different dimensions and differ from one person to another (Hofer & Pintrich, 1999). Prior studies suggest that not all students have the same understanding and justification of knowledge (Hofer & Pintrich, 1997; Muis et al., 2006). For example, it might be an intellectual question for a student with the objectivist or the absolutist perspective that "Is there a point to argue?" (Baytelman et al., 2020, p. 1201). This needs to be investigated to know to what extent students' epistemic beliefs influence their argumentative essay writing. Scientific evidence also confirms that students' argumentation performance could be influenced by their gender (Noroozi et al., 2020; 2022). Gender affects the way students think, argue, and reflect (Asterhan et al., 2012). For example, Noroozi et al. (2020) found that female students deliver deeper argumentation compared to male students.

Although in previous studies, the effects of students' epistemic beliefs and gender on argumentation performance have been separately studied (e.g., Noroozi et al., 2020), there is little to no empirical evidence to investigate the interaction role of epistemic beliefs and gender in students' argumentative essay writing performance. What we know is that gender plays a key role in shaping one's thoughts, and epistemic beliefs are related to gender (Asterhan & Schwarz, 2016). There is a lack of empirical findings to explain how the interacting role of students' epistemic beliefs and gender can affect their argumentation performance in essay writing. Therefore, this study aims to address this gap by addressing the following questions:

1. To what extent students' epistemic beliefs are related to their argumentation performance in essay writing?
2. To what extent students' gender is related to their argumentation performance in essay writing?
3. What is the interaction role of students' epistemic beliefs and gender in their argumentation performance in essay writing?

## Method

### Study design

In this study, 148 undergraduate students (Female: N=101, 68%; Male: N=47, 32%) participated in this study

from Wageningen University and Research. Ethical approval from the Social Sciences Ethics Committee at Wageningen University and Research was obtained. To conduct this experimental study, a module called “Argumentative Essay Writing” was designed and implemented in the selected courses on the Brightspace platform. Students were requested to follow the module for three consecutive weeks and each week students performed one task (Figure 1).

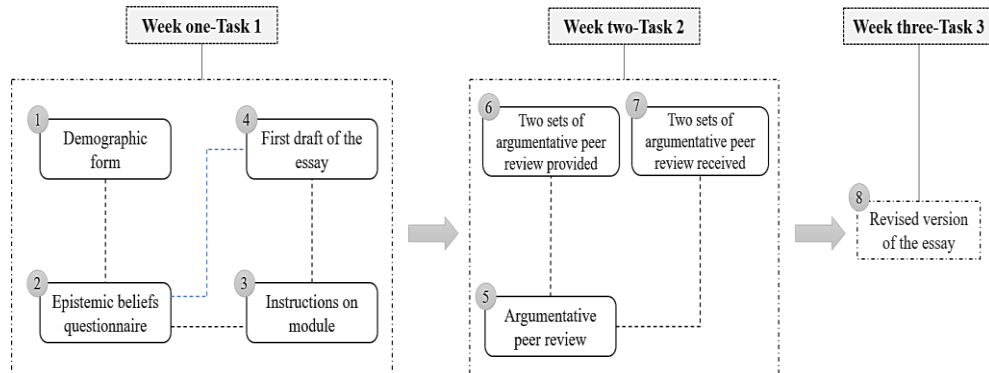


Figure 1. Study design

### Measurement

Students’ epistemic beliefs were assessed in two categories including students’ epistemic beliefs about the Internet-specific justification of knowledge and the nature of scientific knowledge (Cheng et al., 2021). The Internet-specific justification of knowledge entailed 12 items to measure three dimensions including (a) personal justification (4 items), (b) justification by authority (4 items), and (c) justification by multiple sources (4 items). Students’ beliefs about the nature of scientific knowledge were measured in two categories including certainty of knowledge (6 items) and development of knowledge (6 items). Students’ argumentative essays were measured in eight dimensions including: introduction on the topic, position on the topic, arguments for the position, (4) justifications for arguments, counter-arguments, justifications for counter-arguments, response to counter-arguments, and conclusion.

### Analysis

To analyze essay data, five coders cooperated and Fleiss’ Kappa statistic results showed [75% (Fleiss’ Kappa = 0.75 [IC 95%: 0.70-0.81];  $z = 26.08$ ;  $p < 0.001$ ) indicating significant agreement between the coders. Pearson correlation coefficient test and a multiple linear regression test were used to address research questions.

## Results

Results for the first research question showed no significant relationship between students’ epistemic beliefs about the Internet-specific justification of knowledge including personal justification ( $r = 0.039$ ,  $p > 0.05$ ), justification by authority ( $r = 0.174$ ,  $p > 0.05$ ), and multiple sources ( $r = 0.062$ ,  $p > 0.05$ ) with their argumentative

essay writing performance. Only, students' justification by the authority was positively correlated ( $r=0.244$ ,  $p<0.01$ ) and could predict ( $F(3,110)=3.29$ ,  $p<0.05$ ) their arguments in favor of the position. Students' beliefs about the certainty of knowledge were negatively ( $r=-0.251$ ,  $p<0.01$ ), and the development of knowledge positively ( $r=0.207$ ,  $p<0.05$ ) correlated to their argumentative essay writing performance. The results showed that students' epistemic beliefs about the nature of scientific knowledge could predict overall argumentation performance in essay writing ( $F(3,110)=3.80$ ,  $p<0.01$ ). Results for the second research question showed no significant effects of students' gender on their argumentative essay writing performance was reported ( $F(1,146)=0.00$ ,  $p=0.98$ ). However, female students compared to male students showed a higher argumentative essay writing performance in terms of taking a position on the topic ( $F(1,146)=9.64$ ,  $p<0.01$ ). Results for the third research question showed that the overall interaction role ( $F(4,109)=0.32$ ,  $p=0.86$ ). However, an interaction role of the Internet-specific justification of knowledge and gender was found in the arguments in favor of the position section ( $F(4,109)=2.48$ ,  $p<0.04$ ). Male students' beliefs about the Internet-specific justification of knowledge in all category was positively correlated with their arguments in favor of the position section (personal justification,  $r=0.492$ ,  $p<0.05$ ; justification by authority,  $r=0.492$ ,  $p<0.05$ ; justification by multiple sources,  $r=0.492$ ,  $p<0.05$ ). In addition, the interaction role of beliefs about the nature of scientific knowledge and gender in argumentative essay writing performance was reported to be significant ( $F(3,110)=3.24$ ,  $p<0.05$ ). Female students' beliefs about the certainty of knowledge were negatively correlated to their argumentative essay writing performance ( $r=-0.268$ ,  $p<0.01$ ) while it was positive for the development of knowledge ( $r=0.297$ ,  $p<0.01$ ).

## Discussion and conclusion

The findings showed that, overall, students' different epistemic beliefs about the Internet-specific justification of knowledge including personal justification of knowledge, justification by authority, and multiple sources did not differently influence students' overall argumentation performance in essay writing. This finding did not align with the results of most prior studies where it has been found that the students' epistemic beliefs are associated with their argumentation performance (e.g., Baytelman et al., 2020). A plausible reason for this overall contradictory finding with most previous studies could be the specific instructions and guidelines that were provided for all students in this study which might result in alleviation of the effects of students' epistemic beliefs about the Internet-specific justification of knowledge on their argumentative essay writing performance. Our expectations in terms of the effects of students' beliefs about the nature of scientific knowledge on argumentative essay writing were met where students' beliefs in the development of knowledge were positively correlated to their higher performance in argumentative essay writing, while students' beliefs about the certainty of knowledge were negatively influenced their performance in essay writing. This finding is consistent with most prior studies where an influential role of epistemic beliefs on argumentation performance in essay writing has been reported (e.g., Baytelman et al., 2020; Noroozi & Hatami, 2019). This finding can be explained by the theoretical findings for argumentation as it indicates that argumentation requires beliefs on the relativeness of the knowledge and related issues which opens the door for discussion, reasoning, and shaping discourse on the

argued topic. Our findings revealed that female and male students, overall, did not perform differently in their argumentative essay writing. However, for taking a position on the topic, female students outperformed male students. This finding, in general, is in line with a few prior studies where no gender differences were reported for argumentation performance (e.g., Asterhan et al., 2012), and in contrast with main previous studies (e.g., Noroozi et al., 2020). Although the overall performance of female and male students was not significant, better performance for female students for taking a position on the topic can be an indication of females' better performance to a small extent. This means that boys need more support than girls in argumentative essay writing. Our findings revealed that the interaction effects of epistemic beliefs about the Internet-specific justification of knowledge and gender on argumentative essay writing were neutral. This means that. Overall, female and male students' beliefs about the Internet-specific justification of knowledge did not differently influence their argumentative essay writing performance. This finding implies that even though females and males shape their thoughts and beliefs in different ways (Noroozi et al., 2020; 2022), this is not an influential factor when students with different beliefs use the Internet as a source of knowledge to write their argumentative essays. Finally, our findings for the interaction role of epistemic beliefs about the nature of scientific knowledge and gender in argumentative essay writing performance were reported to be significant. This means that female and male students' beliefs about the nature of scientific knowledge including certainty and development of knowledge differently influence their argumentative essay writing performance. Female students with beliefs about the nature of scientific knowledge could perform better in their argumentative essays compared to male students with beliefs about the nature of scientific knowledge. The findings of this study contribute to the literature and can provide implications for educators on how to guide, facilitate, and scaffold students' argumentative essay writing. In addition, due to the emergence of new artificial intelligence technologies such as ChatGPT and learning analytics (Banihashem et al., 2022; Farrokhnia et al., 2023; Noroozi et al., 2019), for future studies, we suggest taking steps forward and examining how these technologies can impact the epistemic beliefs of male and female students with different profiles in online learning (Banihashem et al., 2023c) and support their argumentation performance.

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