

Promoting Ethical Reasoning through Structured Learning and Reflection in a Biotechnology and Sustainability Course

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BACKGROUND

Ethical reasoning and navigating often inevitable and complex power dynamics in research settings are critical skills for developing researchers. Thus, training and developing scholars through effective and adaptable interventions is critical. Case studies and argument analysis have been used to engage participants in analyzing scenarios that address the responsible conduct of research in various contexts. We developed a 200-level biotechnology and sustainability course that leverages the *How We Argue* adaptive course modules (developed by ThinkerAnalytix) and *scaffolded* case study analyses through a template reflection to promote a deeper understanding of complex ethical scenarios. We incorporated discussion forums for learners to share their interpretation of custom-tailored e-waste recycling case studies. Through this approach, participants completed the How We Argue module and transferred their reasoning skills to potential ethical dilemmas in biotechnology and the sustainability of electronic waste reuse. We hypothesized that argument analysis and open discussion of ethical scenarios would promote ethical reasoning skills. Mixed methods, pre-post surveys, and thematic analysis indicated that participants can identify ethical dilemmas yet vary in their ability to articulate the issues and their corresponding impact on power dynamics. Analyses of additional student responses and feedback will aid in the refinement of the case studies and more effective implementation of argumentation training and ethical reasoning in course-based research experiences.

METHODS

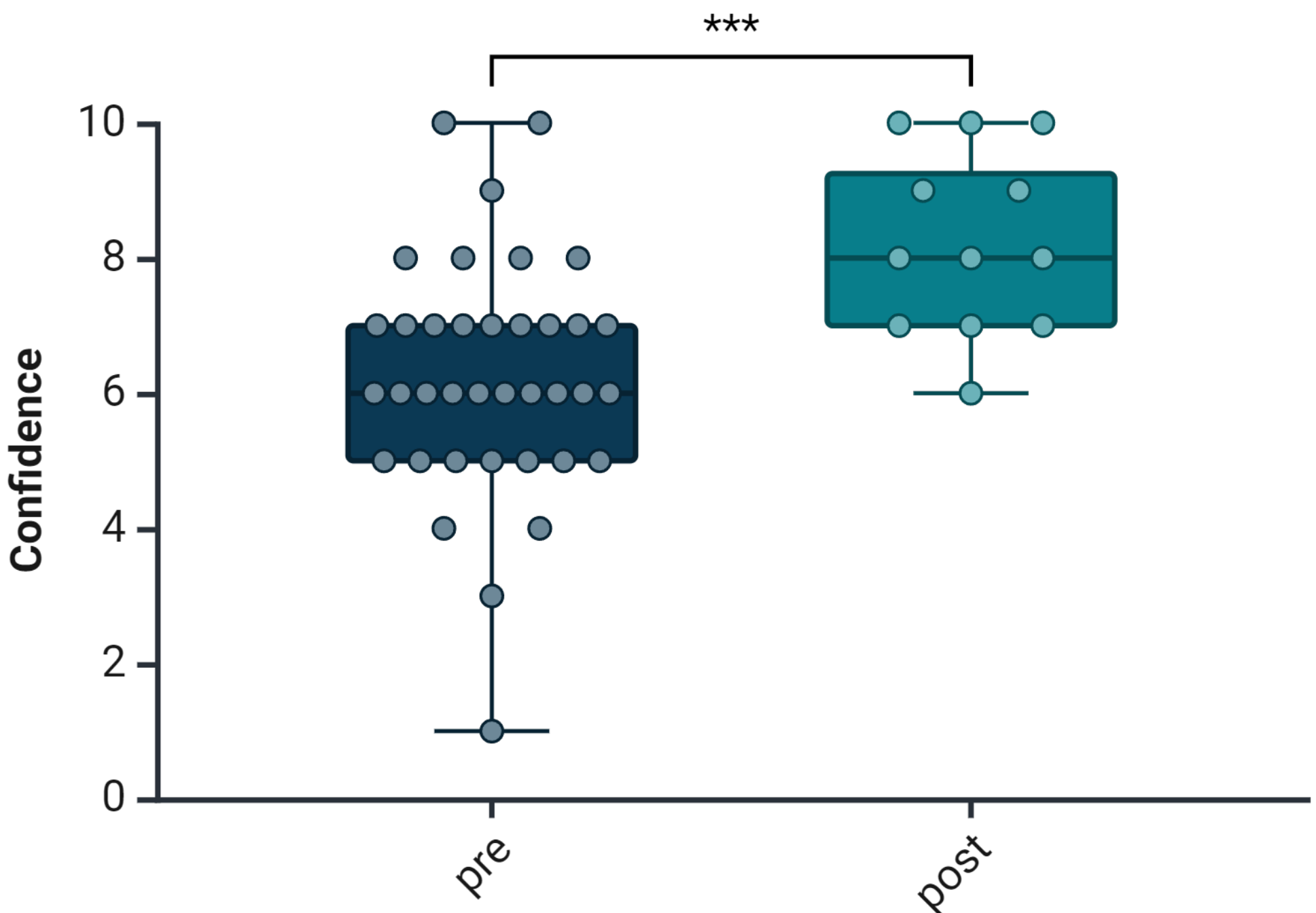
Approach		Modules 1-2	Modules 3-4	Modules 5-6	Modules 7-8
How We Argue Lessons	Self-paced Lessons	[Bar chart showing duration]			
Ethical Case Studies	Self-paced Lessons		[Bar chart showing duration]		
How We Evaluate Lessons	Self-paced Lessons			[Bar chart showing duration]	
Student Surveys	Pre Survey	[Bar chart showing duration]			
	Post Survey				[Bar chart showing duration]

Approach taken to implement ethical reasoning in the BIT 295 *Biotechnology & Sustainability* course. Pre/post surveys were administered along with consent forms. Data from those participating in the study was analyzed and includes pre/post surveys, HWA/HWE, and responses to case studies.

Acknowledgements
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Deliberate Training in Argumentation Helps Promote Ethical Reasoning.

Confidence in Identifying an Ethical Issue in a Collaborative Project



Confidence in addressing others about potential ethical concerns

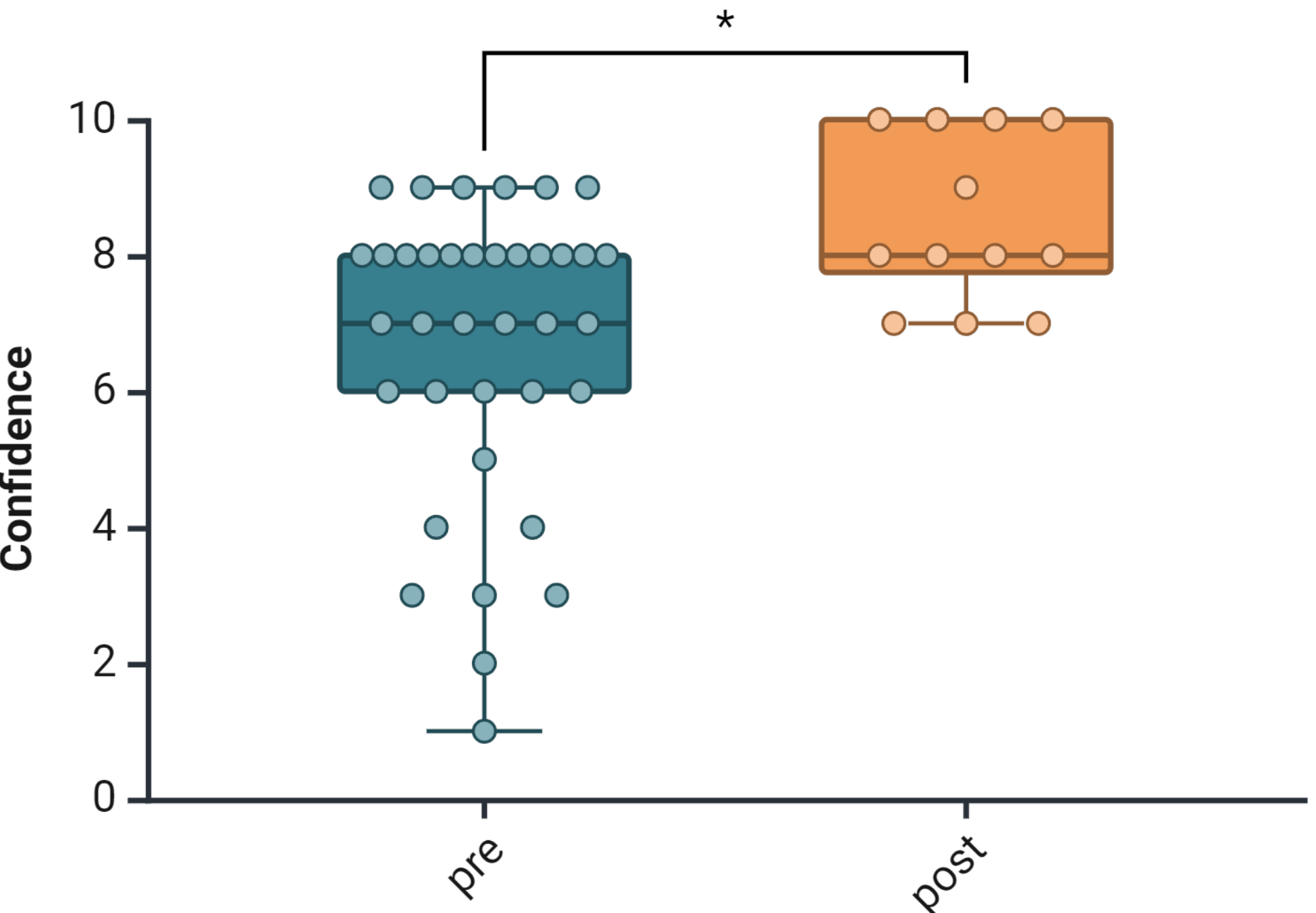


Figure 1. Analysis of pre/post surveys suggests that participants gain confidence in identifying an ethical issue in a collaborative project (A) and addressing others about potential ethical concerns (B). A nonparametric Mann-Whitney test was run. There was a significant effect of Condition: U = 114.000, p = 0.011. An independent samples t-test indicated a significant effect of condition: t(47) = -3.590, p < 0.001.

RESULTS

Student reflections on ethics and responsible conduct of research in the case study scenarios

Theme 1: Collaboration
 Students discussed the importance of collaborating with local researchers who are well-informed about the research issue and the local community.

Theme 2: Scientific Validity
 Students highlighted the valid and feasible research methodology used by the scientists.

Theme 3: Social & Clinical Value
 Students state that the research would not only improve knowledge of e-waste systems but also benefit the respective communities.

Theme 4: Informed Consent
 Students expressed concern that the researchers might not have acquired informed consent from the participants.



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