

## Argument-Driven Inquiry: What does the research say?

"The results from the repeated measures ANOVA revealed that the EG [Experimental Group - ADI] boys and girls made significant and continuous improvement in the quality of argumentation from the first to the second semesters. In contrast, the CG [Control Group] girls presented significantly lower scores than the boy counterparts" (p. 635).

Chen, H. T., Wang, H. H., Lu, Y. Y., & Hong, Z. R. (2019). Bridging the gender gap of children's engagement in learning science and argumentation through a modified argument-driven inquiry. *International Journal of Science and Mathematics Education*, 17(4), 635-655

"The results show that the mathematical understanding ability improvement of students who received Argument-Driven Inquiry (ADI) learning is better than those who studied using direct learning" (p. 32085)

Hidayat, W., & Aripin, U. (2019). The improvement of students' mathematical understanding ability influenced from argument-driven inquiry learning. In *Journal of Physics: Conference Series*, 1157(3), 32085

"After seven weeks of chemistry instruction, students experiencing ADI instruction scored higher on the Chemistry Concept test and the Argumentative Writing Assessment than students experiencing SI [structured inquiry] instruction. Furthermore, girls who experienced ADI instruction scored higher on the assessments than their male peers in the same class" (p. 473).

Cetin, P. et al. (2018) Exploring the effectiveness of engagement in a broad range of disciplinary practices on learning of Turkish high-school chemistry students, *International Journal of Science Education*, 40(5) 473-497

"The results of our analysis suggest that the students enrolled in the general sections of the course made similar or larger gains than the students enrolled in the honors section of the course in their abilities to plan and carry out an investigation, argue from evidence, and write a science-specific persuasive essay when these students had an opportunity to participate in Argument-Driven Inquiry" (p. 101).

Strimaitis, A. et al. (2017). Promoting equitable biology lab instruction by engaging all students in a broad range of science practices: An exploratory study. *School Science and Mathematics*, 117 (3-4), 92-103.

"The results showed that students developed their writing skills in all three aspects: argument structure, argument content, and writing mechanism. However, the highest score in terms of these improvements was obtained in the quality of students' argument content" (p. 841).

Çetin, P. and Eymur, G. (2017). Developing students' scientific writing and presentation skills through argument driven inquiry: an exploratory study. *Journal of Chemical Education*, 94(7), 837-843

"All students enrolled in the ADI sections of the course, including students from under-represented minority groups, females and students with low GPAs, outperformed their counterparts who were enrolled in the traditional sections. In addition, students from under-represented minority groups and females in the ADI group performed as well as the students from majority groups and males in the ADI section of the course and outperformed the students from majority groups and males enrolled in the traditional sections" (p. 1110).

Walker, J. et al. (2016). Using the laboratory to engage all students in science practices. *Chemistry Education Research and Practice* 17(4), 1098-1113.

"Results revealed that the EG [experimental group - ADI] students' total engagement in learning science and argumentation quality were significantly higher than the CG [comparison group] students. In addition, the EG students' anxiety in learning science significantly decreased during the study; and their posttest total engagement in learning science scores were positively associated with their argumentation scores" (p. 170).

Chen, H-T., et al. (2016). Using a modified argument-driven inquiry to promote elementary school students' engagement in learning science and argumentation. *International Journal of Science Education*, 38(2), 170-191

"The results showed that ADI was more effective in improving the academic achievement and science process skills of pre-service science teachers compared to traditional laboratory instruction" (p. 267).

Demircioglu, T. and Ucar, S. (2015). Investigating the Effect of Argument-Driven Inquiry in Laboratory Instruction. *Educational Sciences: Theory and Practice*, 15(1), 267-283.

"Analyses yielded that the students in the treatment group [ADI] not only outscored the students in the comparison group on the science achievement tests, but also demonstrated significantly higher performances in writing and argumentation scores." (p. 386)

Demirbag, M. & Gunel, M. (2014). Integrating Argument-Based Science Inquiry with Modal Representations: Impact on Science Achievement, Argumentation, and Writing Skills. *Educational Sciences: Theory and Practice*, 14(1), 386-391

"These results suggest that the use of an integrated instructional model [ADI] that places emphasis on argument and argumentation can have a positive impact on the quality of the arguments students include in their investigation reports, the argumentation they engage in during lab activities, and their overall performance on tasks that require them to develop and support a valid conclusion with evidence" (p. 561).

Walker, J. and Sampson, V. (2013). Learning to argue and arguing to learn: Argument-driven inquiry as a way to help undergraduate chemistry students learn how to construct arguments and engage in argumentation during a laboratory course. *Journal of Research in Science Teaching*, 50(5), 561-596.

"Changes in student performance on the two assessments over time indicate that the students' science-specific argumentative writing skills and their understanding of core scientific ideas improved over [school year]. Furthermore, students who participated in a greater number of ADI activities demonstrated greater and more consistent improvement in their writing" (p. 643).

Sampson, V., Enderle, P., Grooms, P., & Witte, S. (2013). Writing to Learn by Learning to Write During the School Science Laboratory: Helping Middle and High School Students Develop Argumentative Writing Skills as They Learn Core Ideas. *Science Education*, 97, 643-670.

"The results of a quantitative and qualitative analysis of the reports and reviews indicate that the participants made significant improvements in their ability to write in science and were able to evaluate the quality of their peers' writing with a relatively high degree of accuracy" (p. 1443).

Sampson, V., and Walker, J. (2012). Argument-driven inquiry as a way to help undergraduate students write to learn by learning to write in chemistry. *International Journal of Science Education*, 34(10), 1443-1485.