

Argumentation-in-practice: using action research to develop argumentation practices in secondary science

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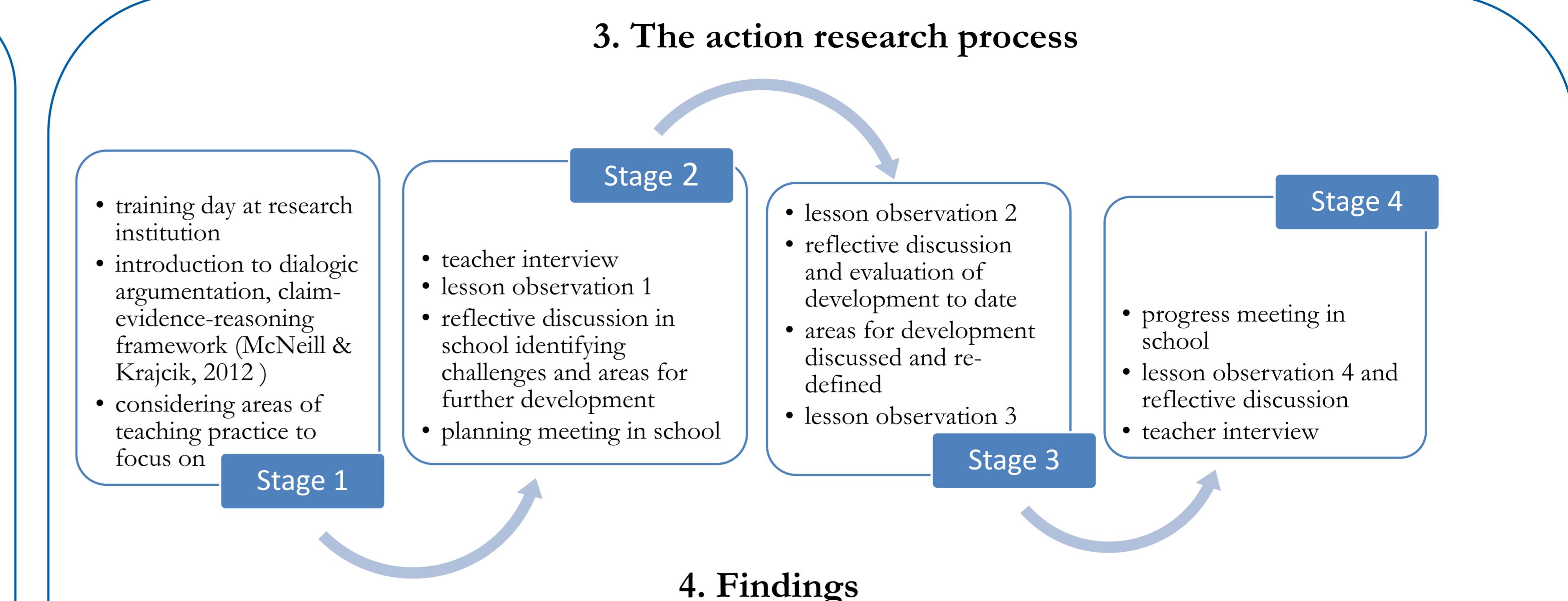
1. Introduction and Aims

For a number of years now there has been increasing interest in the way that argument can be utilised in science education (Driver et al., 2000; Erduran & Jiménez-Aleixandre, 2008). Educational reforms now incorporate argumentation with reports such as Taking Science to School and the Next Generation Science Standards (NRC 2007, 2012) including argumentation as one of the scientific practices that should be taught in K-12 science education. Driver et al. (2000) pointed out the limited pedagogical repertoire of science teachers when it comes to using dialogic argumentation in the science classrooms. Almost 15 years later, the same challenges are still noted in the literature, with teachers facing various challenges in implementing argument-based instruction (McNeill & Knight, 2013; Simon et al., 2006). Professional development programs have been supported as a way towards promoting learning and changing pedagogies (Borko, 2004; Loughran, 2014) and therefore are an appropriate route to developing the use of argumentation in the science classroom.

Simon et al. (2006) report on the instructional practices of five teachers identifying an array of argumentation processes in the teachers' talk, such as talking and listening; justifying with evidence; constructing arguments; evaluating arguments; counter-arguing/debating; and, reflecting on argument process. The teachers' use of these argumentation processes was enhanced from the beginning to the end of the year, although change was not noted for all processes and all teachers. McNeill and Knight (2013) run a professional development intervention with 70 elementary, middle and high-school teachers, and report that although teachers developed their knowledge of the structural components of argumentation improving their ability to distinguish various parts of arguments, the same changes in their classroom talk was not identified; applying argumentation in classroom discourse remained a challenge. They attribute this to the emphasis placed during the workshops on structural elements of argumentation instead of argumentation-in-practice. Professional development initiatives that include classroom practice in their design, where teachers can practise new strategies and reflect on them, are needed to complement approaches such as the ones reported above. The focus of this study was to explore ways in which science teachers can be helped to develop their teaching practice consistent with argument-based instruction, and do so through engaging them in action research. The RQ explored is: *Does an action research approach to professional development of argumentation practices facilitate change in a teacher's instructional practice?*

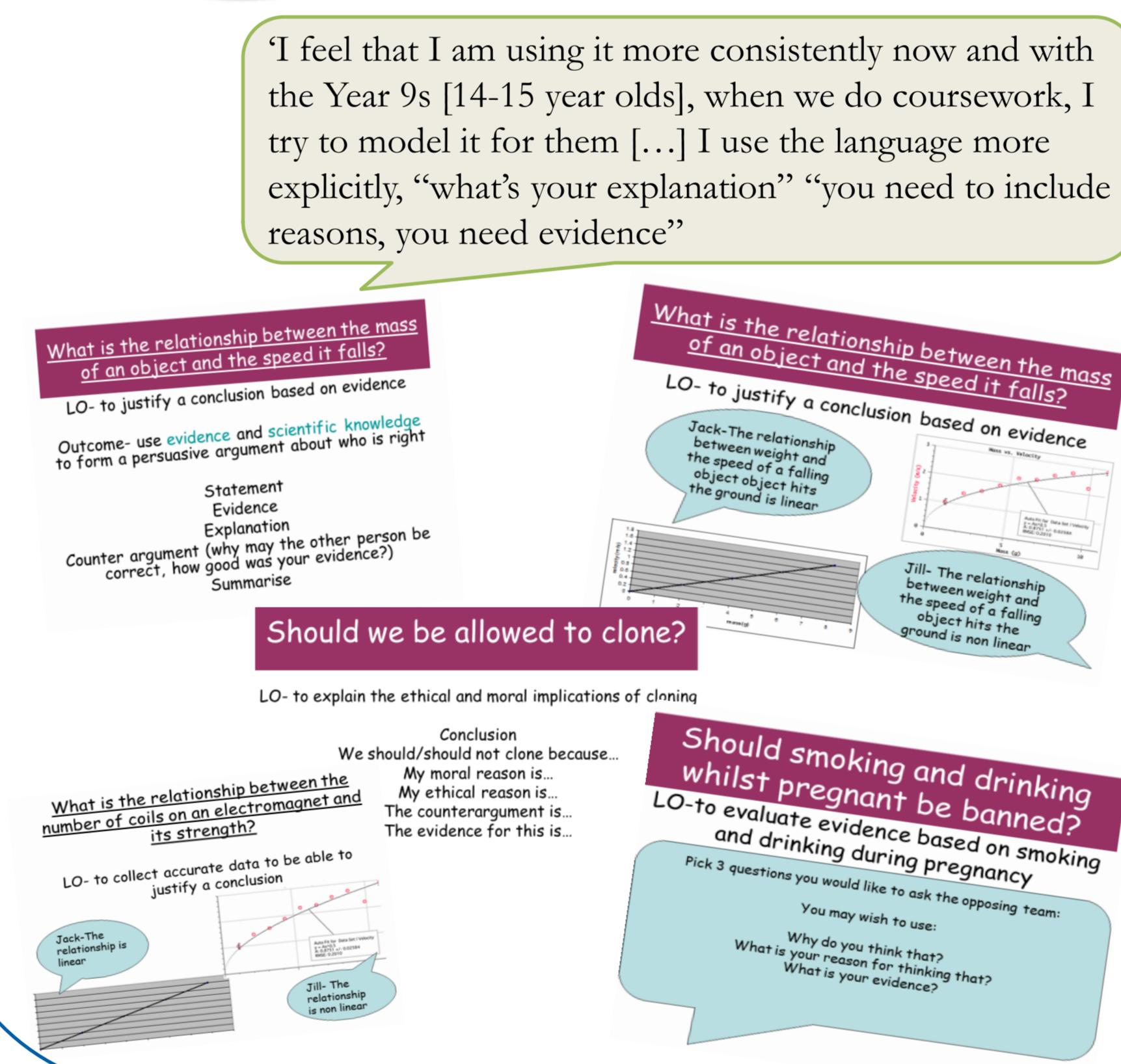
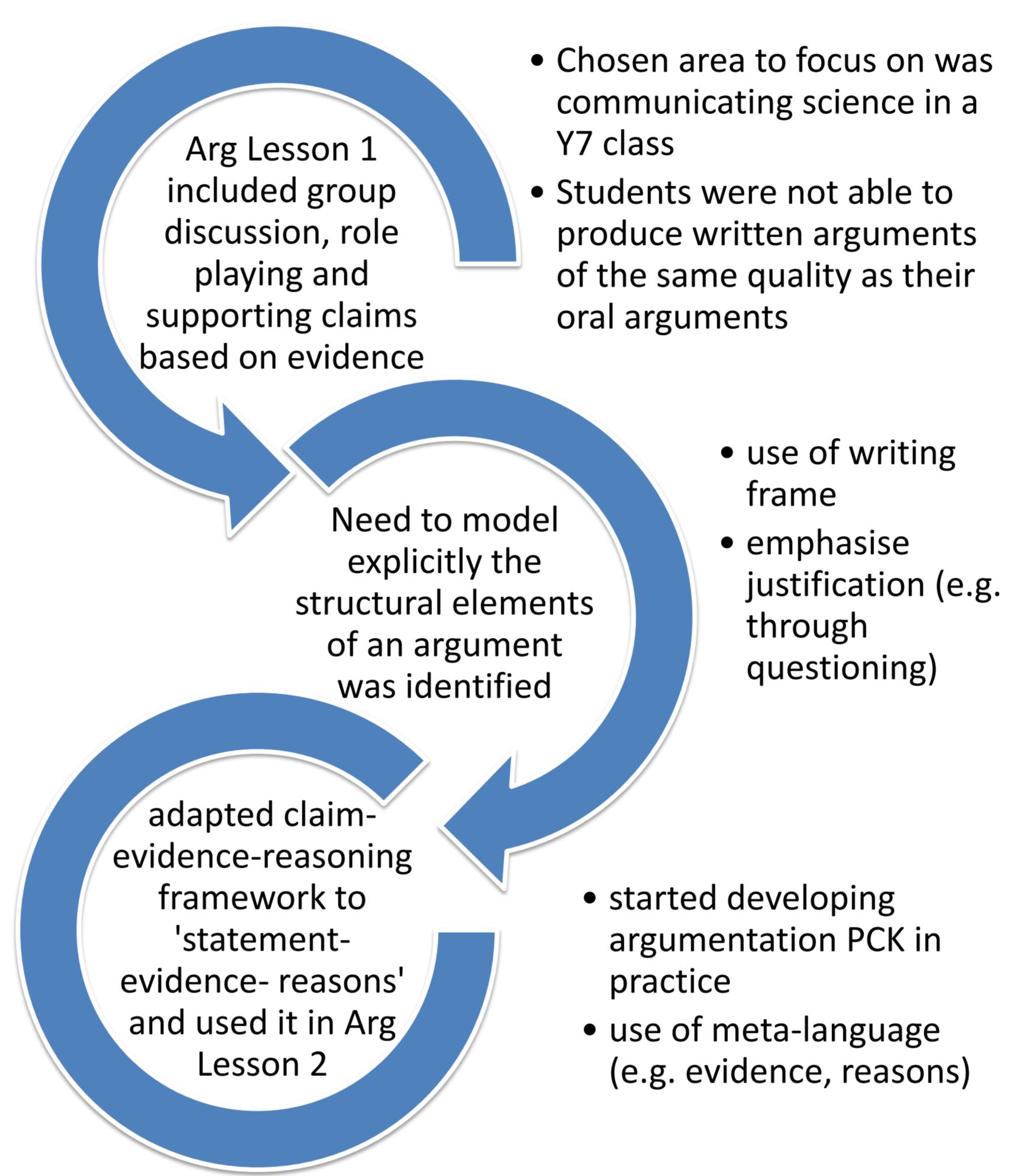
2. Study Design, Sample and Methods

- qualitative, exploratory study focusing on professional development through action research, which is defined as 'an action-reflection cycle of planning, acting, observing and reflecting' of own practices (McNiff, 2013, p.56)
- one middle school teacher, had 5 years of teaching experience; wanted to make her lessons more interesting and engaging for her students
- 8-month duration (Dec 2013 – Jul 2014) and data collected included lesson observations, reflective discussions and interviews, field notes, lesson plans and resources
- narrative analysis and thematic analysis approaches used (Alvesson & Sköldberg, 2009)

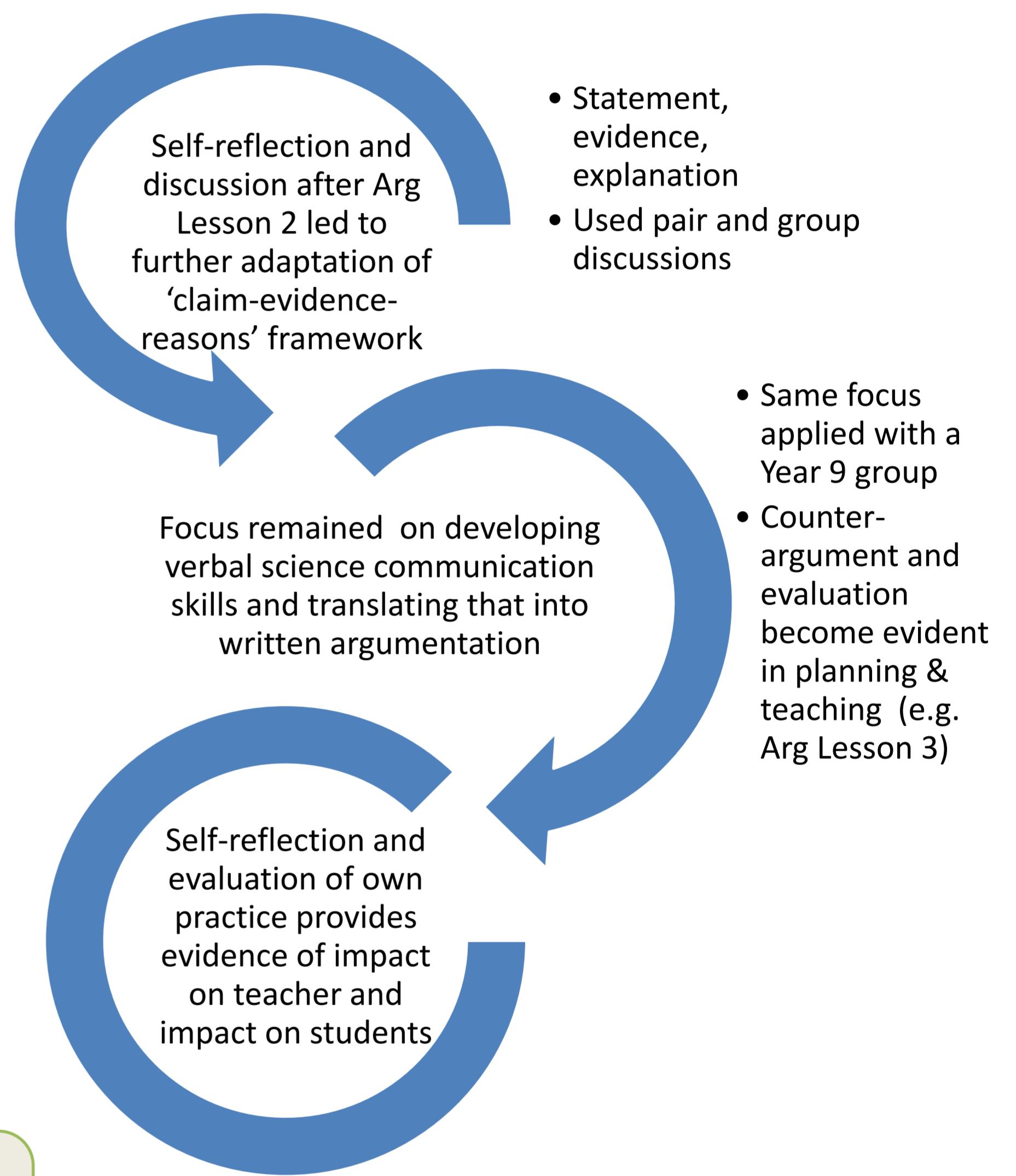


4. Findings

Initial steps and first challenges: talking science based on argument



Reflecting on own practices and developing argumentation practices



I: What about the impact on students?
T: I think it makes them want to know more.
I: Why do you say that?
T: Because before, they would write a conclusion that would be it. Now, they're asking me for iPads, they're asking to look things up on the internet, they're asking me to [...] take them to the library, and they're not just happy with having a set bit of information, they've got more of a thirst for knowledge, I think, and they want to be able to explain things, especially the Year 7s.
I: Why do you think there's this emphasis on explanation?
T: Yeah, because I've been saying, 'Well, you should explain that', and I have always had lots of different books in the cupboards, and I say, 'You can go and use any of my books that I've had from A-Levels or my degree, or any books I've got on the way', and they're really... I don't know, for some reason, that's the first time my cupboards' ever been used. I used to have all these books in there and no one would do it when I said it before. And they like having different... Not being able to do all the same set tasks. They like having been able to go their own routes and find out what they want to.

5. Discussion and Conclusions

- The teacher taught successful argument-based lessons, and noted the impact of her changing practice on her students' (a) use of the language of science, (b) attitudes towards collaborating, and (c) ability to use evidence in support of their claims
- Opportunities for critical self-reflection of own practices (McNiff, 2013) facilitated the development of argumentation PCK (McNeill & Knight, 2013)
- Role of researcher as 'a critical friend' (Kember et al., 1997) in the process of action research facilitated reflection and provided suggestions or helped teacher identify potential solutions to problems arising
- Progressive adaptation of structural elements of argumentation enabled the teacher to embed such elements in her everyday practices and classroom discourse (e.g use of evidence, reasons)
- The developing self-confidence in own argumentation practices was strengthened by observed positive impact on student learning, which facilitated further engagement with argumentation practices. Perceived (or actual) impact on students is critical in long-term PD programs as they can impact on the self-efficacy of teachers (Sandholtz & Ringstaff, 2014) and can help sustain the use of new instructional practices (Loughran, 2014)

6. References

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