



Questioning the Questions

Weighing the pros and cons of teacher-led and student-led questions in science classrooms

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Introduction

What we'll discuss:

- Benefits and challenges of teacher-led and student-led questions
 - An example of how to combine the two
 - Specific considerations for investigable questions in the STEM classroom
 - Example of how to transform an investigation based on teacher-led questions into one based on student-led questions
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Teacher-led questions

- Carefully crafted higher order or “deeper” questions, especially free response questions, foster higher order thinking and conceptual understanding (Talbot et al, 2018, p. 37)
 - Unfortunately, in reality much current science education practice still involves constrained-response, lower order questions (Talbot et al, 2018, p. 36)
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Student-led questions

- “Students learn more by asking and answering effective questions than by memorizing facts” (Aghekyan, 2018, p. 76)
 - Students accustomed to answering lower order questions will struggle to generate higher order questions without support (Talbot et al, 2018)
 - Students must feel that they are in a safe environment and will usually need teacher modelling and guidance before engaging with higher level questioning (Toledo, 2015)
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A happy medium?

- Given these pros and cons, a combination of teacher-led and student-led questions is likely to be the optimal approach
 - For example, Toledo (2015, p. 278) describes a modified list of probing questions for use in Socratic questioning that involves the instructor modelling non-judgmental, non-blameful language
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On investigable questions

Children will of course naturally generate questions, but if left to their own devices, many of the questions that they ask will not be investigable (Sharkawy, 2010, p. 32)

Some teacher-generated modelling will likely be required initially; for example, by changing students' "why" questions into "what would happen if" questions (Sharkawy, 2010, p. 33)

Past teacher-led example

- Using PhET Colorado's "Wave on a String" ([n.d.](#)) simulation, students answer a series of carefully designed questions in order to discover how a wave crest propagates through a medium, and the factors that affect wave speed, wavelength and frequency
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Modified student-led approach

- Students could be invited to generate their own investigable questions related to two or more wave parameters, and then collect data from the simulation in order to answer those questions.
 - This approach would likely require some prior practice with generating investigable questions, and/or a resource that scaffolds the generation of investigable questions for them. It would also require time for students to collect and process data.
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Conclusion



A combination of teacher-led and student-led questioning is optimal, with more teacher-led questioning near the beginning of an activity



Most students will require scaffolding and guidance before they can generate higher level or investigable questions



Consider ways to focus natural student curiosity towards generating investigable questions

References

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