The Research Files Episode 47: Gender bias in Science education

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Hello, and thank you for downloading this podcast from Teacher *magazine. I'm Rebecca Vukovic.*

My guest for today's episode of the Research Files is Dr Carol Newall, a Senior Lecturer in Early Childhood Education at Macquarie University. She joins me today to talk about a study she led which investigates how a child's gender impacts an adult's perception of their ability and their enjoyment of Science. The 80 adult participants in this study were all Macquarie University students, 20 of whom were education students and 60 were studying psychology.

These adults were given a fictional profile of an eight-year-old child with the task of teaching that child over Skype. Each child's fictional profile was experimentally manipulated depending on whether they were boy or girl, and the stereotypes associated with that gender. For example, one child liked tea parties and the colour pink and another liked climbing trees and the colour blue.

As Dr Newall will explain in today's episode, the results from this study revealed that participants rated girls as less academically capable than boys in Physics, and they delivered less scientific information during their teaching module when they believed they were teaching a girl. To kick things off, I ask Dr Newall to explain her motivation for conducting this research in the first place.

Carol Newall: I accidently came across a little blurb in an article that said that parents explained scientific concepts to girls and boys differently on museum visits. So when I looked at the actual research itself, they had not experimentally manipulated whether the child was a boy or a girl and that's the nature of a lot of naturalistic kind of experiments.

So one possibility that occurred to me was that when a girl was interacting, a daughter was interacting with a museum exhibit for example, they may not ask as many questions or they may be more introspective when they're looking at it. So parents may have reduced scientific explanations because of all these other confounding variables. And it's part of this kind of research, but one of the things we cannot be sure of is that there is a gender bias because gender was never experimentally manipulated.

So I was sort of inspired to try and manipulate gender to see whether it was the cause of biases and so that was how we decided to develop this particular study.

Rebecca Vukovic: Of course your research examined gender stereotypes and how they may reduce the quality of girls' early educational experiences in STEM [Science, Technology, Engineering, Mathematics]. Could you run listeners through some of your key findings?

CN: Yes, so the first thing we did was we tricked adults into believing that they were going to interact with a child over Skype. Now this child didn't exist, and we gave them profiles of children. The profiles for one group of children were identical, except that we varied whether it was a boy or a girl and it was quite gender neutral as well. So if we were to take their names out of it, it would be very hard to guess whether it was a boy or a girl. In another group, we had a very stereotypical girl who liked pink and liked tea parties and a boy who was very

stereotypically male, likes climbing trees, favourite sport was cricket.

And therefore we got participants to initially just do a couple of things like teach a scientific module before they discovered anything about the child. And then we would present them with these profiles, and then we got them to rate the child in terms of their ability in Physics and Biology and also how interested they would be in these topics. But the last part was we also got them to teach the child over Skype a specific scientific module that we had trained them in.

And what we found was when they discovered that they were teaching a girl, they rated her as less able. And it didn't matter whether she was stereotypical or quite ambiguous in her likes – the gender alone determined whether they thought she had ability in Physics. The other thing we found was that the stereotypical girls – the girls who were 'girly girls' – adults tended to assume that she wouldn't be interested in Physics or Biology. And then the last part was that when they discovered that they were teaching a girl – this is regardless of whether she was 'girly' or whether she was quite gender neutral – they reduced the amount of scientific content in the way they taught a scientific module.

RV: In this study, interestingly, you found that even when girls are able to access STEM education, the quality of their experience differs from that of boys. Could you share more about this?

CN: Well not my study but other studies have looked at real life classrooms and examined how teachers talk to their students, and it's not just in Physics but in Science in general, we tend to ask girls less challenging questions, and that's really important – to be challenged in a classroom and to assume that you can answer these questions. But also, previous research has found that teachers tend to spend more time with boys in Science as well.

So those very subtle things, even those very subtle at any point in time when we're doing these sorts of research, you've got to think about girls and their many years of schooling. And even if we're losing just five minutes each time in a classroom, over the many years it accumulates to many hours less of the teachers' time, just because she's a girl. So it has an impact over time.

RV: And Carol you touched on this earlier but I'd just like to go into a little more detail if we can, about the four fictional student profiles that were used in this study. I was wondering how you went about actually creating these profiles.

CN: Well initially I came up with it because my daughter had just started school and her teacher had sent out these questionnaires to get to know her students, right. So they would ask, 'what's your favourite hobby?' 'What's your favourite colour?' 'What foods do you like eating?' So that was sort of the spark because we know that primary school teachers do this and it's a way of getting them to know their students.

But what we did was we validated these profiles as well. So we created it based on a template that's very similar to what I've encountered in primary school but then we road tested it. So, before we even used it in the experiment, we created these four profiles and then we blanked out the names and the gender. Then we got pilot participants to have a guess of whether they were boy or girl and whether they were more feminine or masculine. And we got ratings in the right direction before we ever used it in our study.

So for the ambiguous group, participants could never tell whether it was a boy or girl, it was right plonked in the middle in terms of their ratings, and for the stereotypical girls they were able to guess that it was more likely to be a girl and for the boy, they guessed that it was more likely to be a boy. So that was how we did it, we validated our vignettes, our little profiles before we ever used it in this study .

RV: And another one of the really interesting points to come out of this research was that the two teaching modules used – Biology and [Earth] Science are not typically associated with gender disparities, so could you expand on that point a little?

CN: Yeah we initially wanted to use something like Physics or Chemistry or even Mathematics, because this is where we do typically see more masculine cultures and what we discovered was

when we tried to include a Physics component, that our trial participants just found it really difficult to teach. So they found it quite scary and we hardly got any information from them when they were trying to teach these subjects. So Physics, just in general, whether you're a male or female, seems to intimidate the general public. So we had to throw out the more masculine-associated disciplines and therefore we focused on Earth Science and Biology.

And that was really surprising to us because, by default, it was due to necessity, we didn't really have a choice, we picked these two modules, and yet we still found a gender difference – which tells you it's quite pervasive. Even though we're not seeing massive gender distributions in these areas, we are still teaching girls less scientific content as they are learning from us. And think about what an impact that has in terms of informal teaching by parents. We give girls less opportunities to develop their skills, but we also convey the message to them that 'hey, Science is not the right discipline for your gender'. So that can have quite a pronounced impact later on, but we still need to track that longitudinally.

RV: And I want to talk a little bit more now about the impact. So given all the research you've done in this area, what implications does it have or does this research have on student learning?

CN: I think the first one is just be a little bit careful because this is one experimental study that sort of supports all the other studies that have come before it, that haven't been experimental. So it does tell us that definitely gender is playing a role. And it likely does have an impact because we're seeing it in the statistics of … the female representation in these fields like Physics and Mathematics. For example, only [three] women have won the [Nobel Prize in Physics], only one woman has even won the Fields Medal for Mathematics – so it's reflected. It's consistent with what we know about these areas.

So we can tentatively suggest that it does have an impact and it has an impact in the sense that we're really not reaching our full talent pool. So these areas really need more enrolment, they need innovation, they have an impact across almost all fields. Think about Mathematics, it's pervasive in everything that we do, and yet we're only tapping half the talent in our population. So not only is it costly to girls, but it's costly to us as a community as well.

RV: And so for teachers listening, what could they do to reduce gender stereotypes and the impact of those stereotypes in their own classroom settings?

CN: I think it's a really hard one to answer because the adults in my experiments, they weren't mean. They didn't believe that they had a gender bias so it's very implicit, we think it's really quite subconscious as well. So we do have to wonder whether it is in our control, you know. The hardest question is this idea of a cultural change; we need to slowly change the culture of how we think about male and females and what fields they 'belong' in. And that's a hard task. So there's no simple question to this.

But a few simple things that teachers can do, and I'm sure they're already fostering gender equity in their classrooms, they're trying their best but the subconscious biases might still exist. So a couple of things could be, I would suggest really 'blinding' the way you mark Maths tests or Physics tests to make sure that knowing the students' gender is not going to impact the way you're going to mark these particular tests or exams. I think that's really important because if it's subconscious, it's very hard for you to just consciously try and control it. It's there. So blinding those opportunities, those exam assessment marks are I think quite important.

But the other thing is to look at just representation. So actually when opportunities come up, we've seen in research that teachers tend to take male students as well, so I think it's really important to get some female students in there and to even, I hate using quotas but just to be careful, keeping your statistics there to have a look at whether your top females are also being selected as well and whether there is biases there. She might just be as competent but just because these very long biases that are sort of creeping in to the way we assess, may occlude us from realising there may be some female students that are really quite strong in this area and who would really develop from extracurricular opportunities in this area.

That's all for this episode. If you're keen to find out more about this research, you'll find links to the full study in the transcript for this podcast, which is available at

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References

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