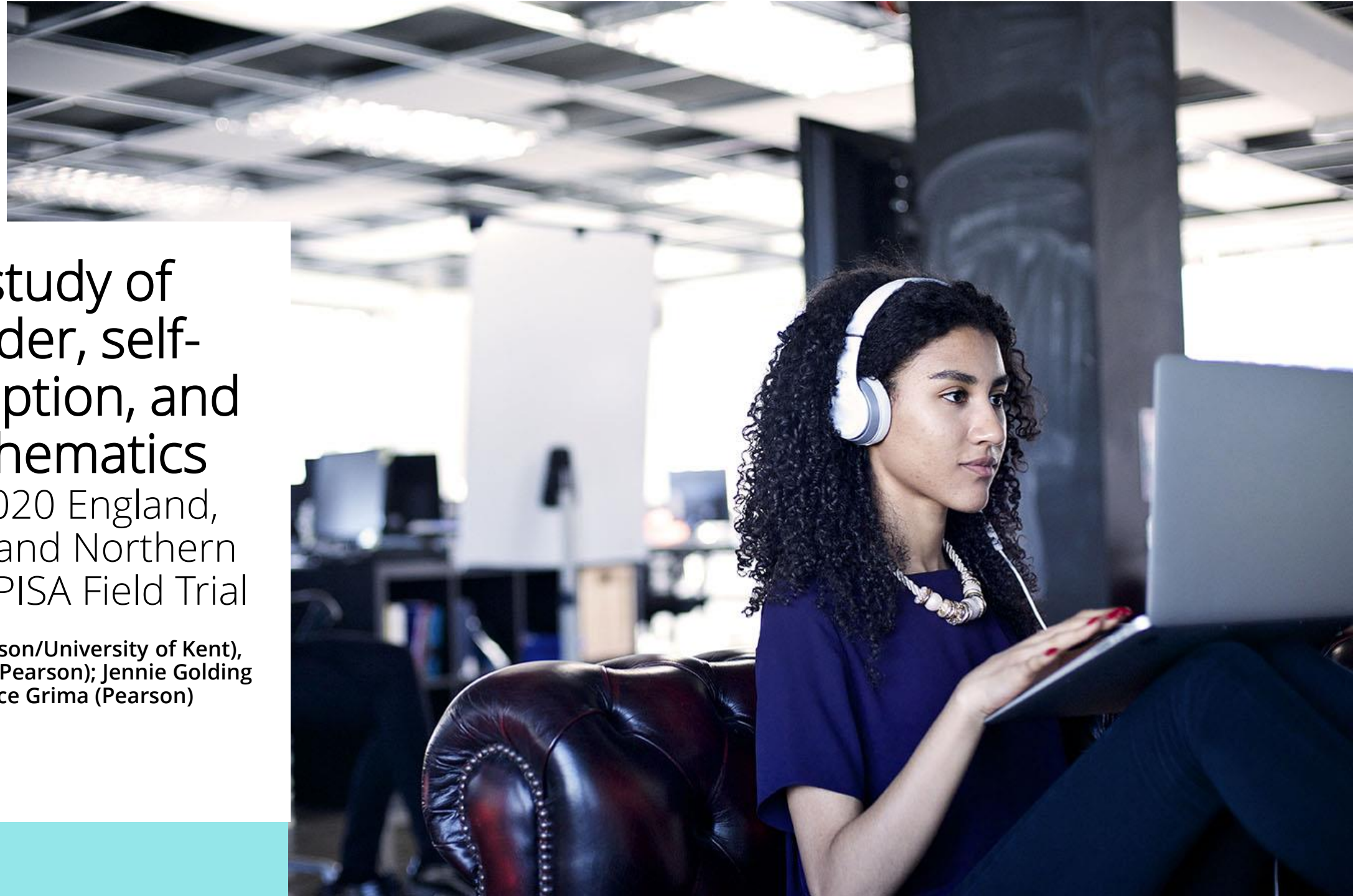
Pearson



A study of gender, self-perception, and mathematics

The 2020 England, Wales, and Northern Ireland PISA Field Trial

Mark Hill (Pearson/University of Kent), Irene Custodio (Pearson); Jennie Golding (UCL); Grace Grima (Pearson)

Data: The 2020 Pisa Field Trial

2020 PISA Field Trial in England, Wales and Northern Ireland

1. Student Survey
2. Information and communication technology (ICT) survey
3. School survey
4. Mathematics assessment

2015 and 2018 Pisa surveys

Schools and Students

19 schools* had students complete both the assessment and student questionnaire; 20 schools returned the school questionnaire with enough data to analyse.

742 students took part in the assessment and questionnaire. Of these students 313 are females and 429 males.

Two schools were all-boys and one was all-girls. The students from these populations make up roughly 22% of the male respondents and 11% of the female respondents.

All students were born in 2004 and were in either year 10 or 11 in England and Wales, or year 11 or 12 in Northern Ireland.

*Intended FT sample size was 40 schools. FT was cut short due to the Covid-19 pandemic.

Data and representativeness

Characteristic	PISA FT	England (2019/20)
Local community: Rural	22.73%	19.13%
Local Community: Town	36.36%	41.02%
Local Community: City	31.82%	39.83%
Academy/Free School (schools)	50.00%	37.1%
Maintained School (schools)	31.82%	53.3%
Independent School (schools)	9.09%	9.6%
Academy/Free School (pupils)	33.0%	49.7%
Maintained School (pupils)	57.3%	43.8%
Independent School (pupils)	9.66%	6.5%
Year 10 and 11 EAL students	12.00%	17.10%
Year 10 and 11 SEN students	17.16%	11.41%
Year 10 and 11 from socioeconomically disadvantaged homes	22.82%	15.90%

Representativeness, while not perfect, is good.

PISA is not meant to be representative, but due to low response rate representation is a good metric to judge the usefulness of the data.

Additionally, identical questions asked in 2018 and 2020 were compared. No extreme variations. Only four out of 25 questions were different enough to be statistically significant.

Country	Percent of total pop.	Percent of PISA FT
England	91.8%	81.8%
N. Ireland	3.1%	4.5%
Wales	5.1%	13.6%

Levels of analysis

"[F]ive factors that are widely found to affect students' intentions to study mathematics at A-level that could be influenced by school practices" (Smith, 2014)

1. Self-assessment
2. Enjoyment
3. Interest
4. Perceived utility
5. Perceived competence

Self-assessment: females find maths harder

Why is this important: Prior attainment and self-assessment limit one's perceived options for future study (Matthews & Pepper, 2007; Noyes et al, 2009).

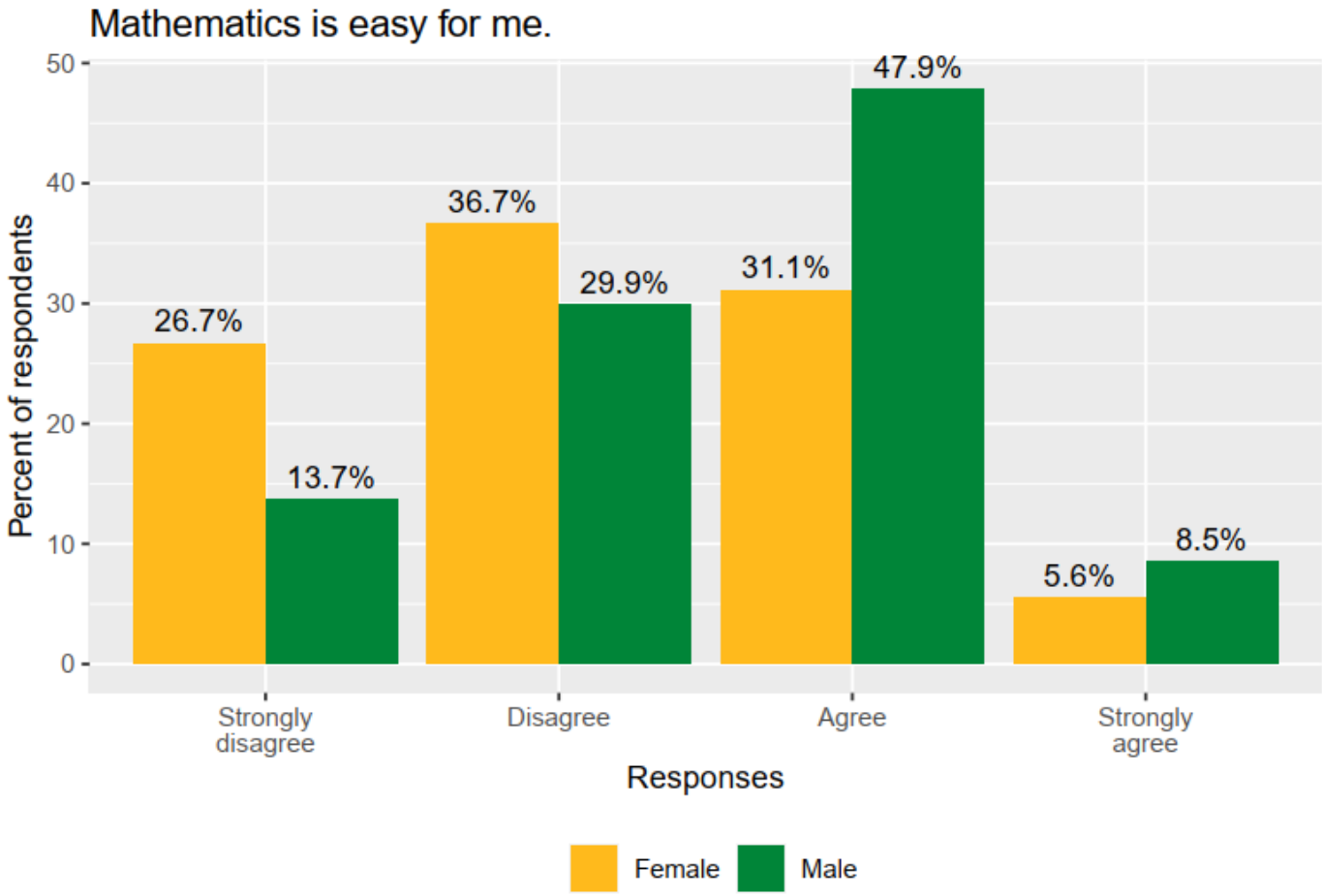
Question: Are females, despite actual assessments, under-estimating their ability?

Data: No statistical difference in assessment results between genders on the whole

56% of males report that "Mathematics is easy for me" compared to 37% of females ($p < 0.05$).

No statistical relationship repeated with Science and English.

Males who did well more likely to self-asses maths is easy. Females are not.



Enjoyment: females enjoy maths less

Why is this important: Students are more likely to continue studying mathematics if they have positive emotional responses to it (Mujtaba & Reiss, 2013).

Question: are females enjoying maths less?

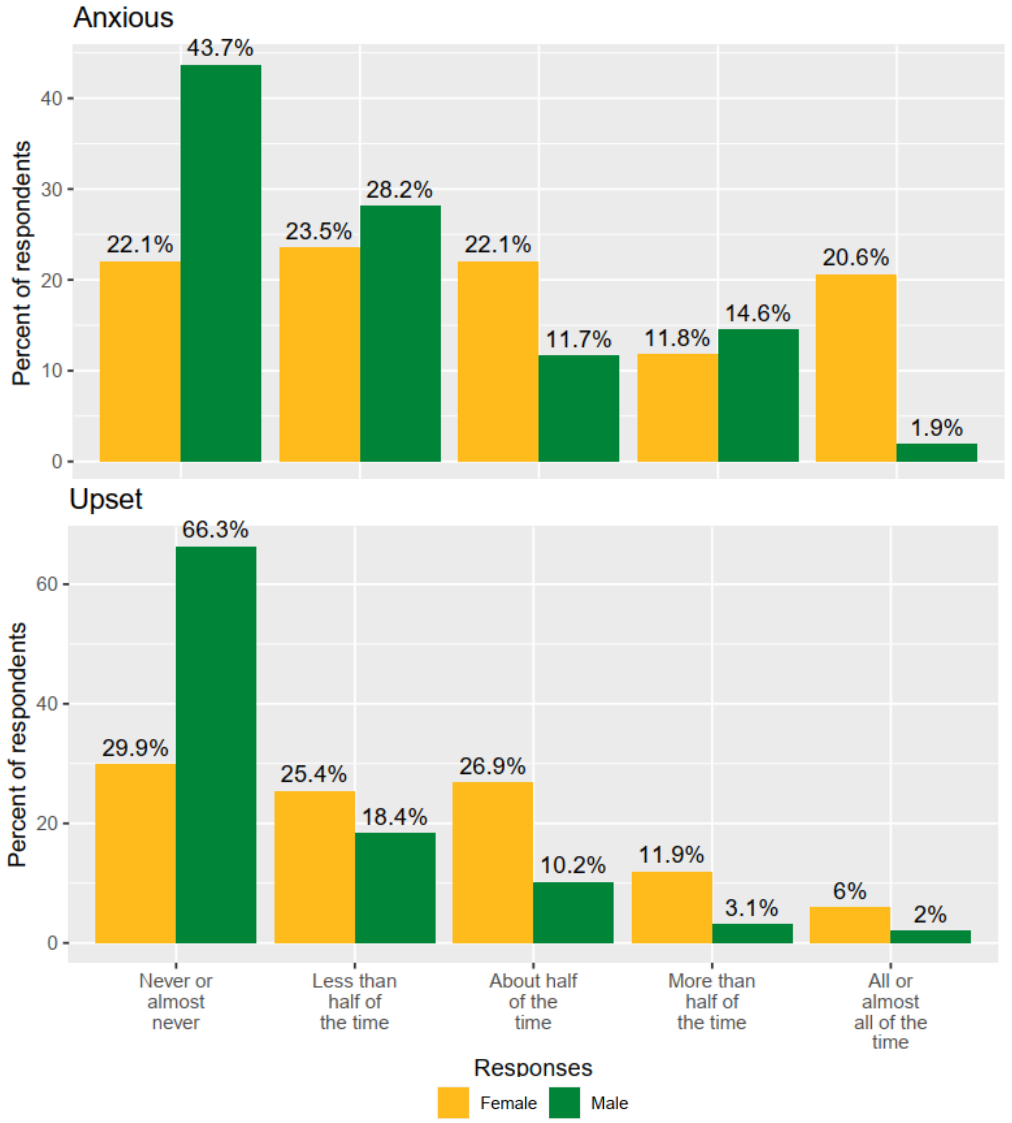
Data: Mathematics the least favourite subject amongst females, including those who reported it as "easy."

Being anxious and upset is statistically more common amongst females ($p < 0.001$).

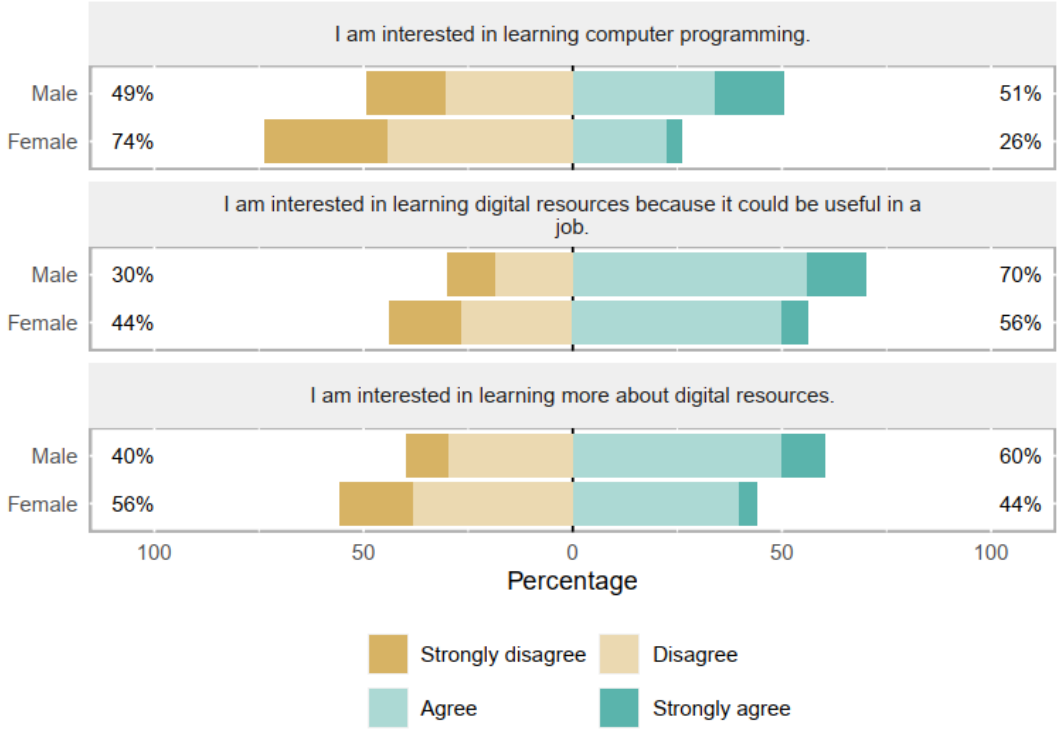
Anxiety more frequently related to "doing well" rather than the act of doing mathematics (both genders).

Those who feel less anxious statistically more likely to do well; those who feel more anxious less well.

Vicious cycle?



Interest: females less, except when tied to utility



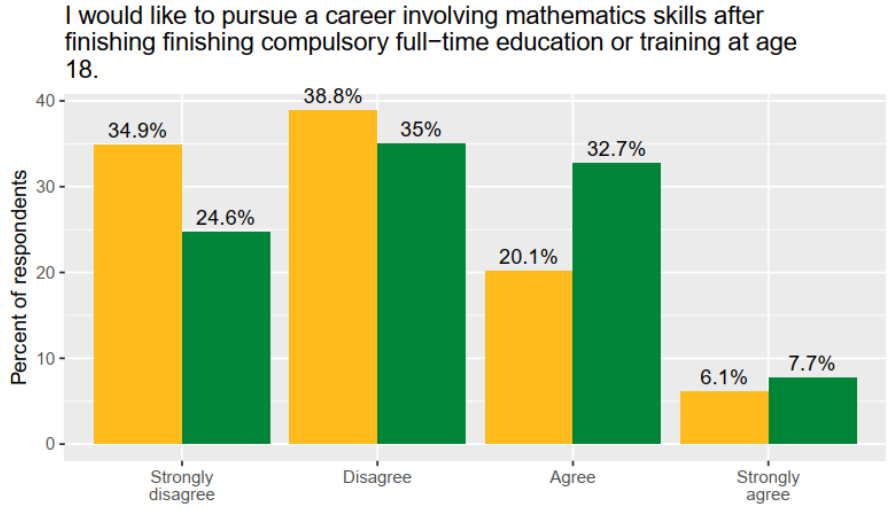
Why is this important: Interest is prerequisite for females choosing to study it in further education (Brown, 2008).

Question: are females less interested in maths?

Data: Females are less interested in their maths lessons than males.

They are less interested in careers using maths ($p < 0.005$)

Interest increases when the question is posed through lens of career utility – majority interested.



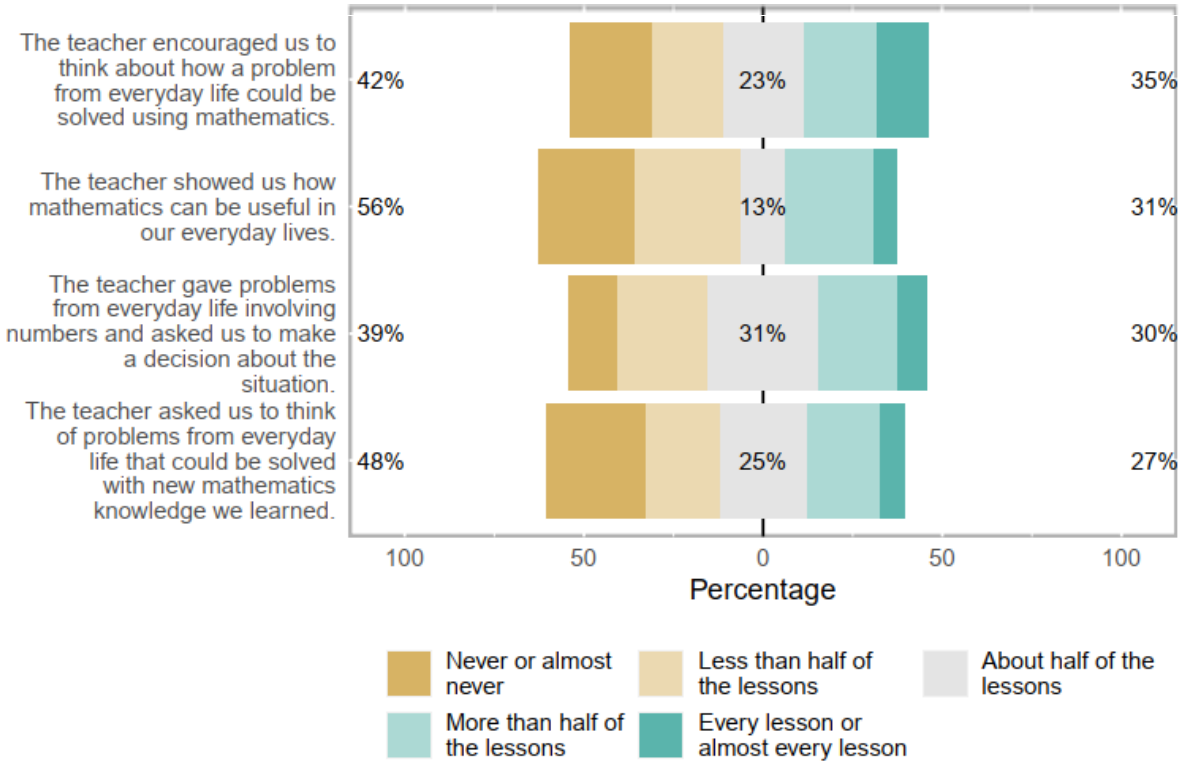
Perceived utility: impact on females greater

Why is this important: Females perceive less utility in mathematics than males (Halpern, 2007; Hodgen, 2013), and it is the second most common reason given for avoiding mathematics (Brown, 2008).

Question: Is there evidence that students (of either gender) fail to see/be shown the utility of maths?

Data: A majority of both genders report lessons fail to make the relationship between mathematics and the real world obvious.

Females are statistically more likely to report that this relationship is not made in their lessons ($p < 0.05$).



Perceived competence: complex picture

Why is this important: Like self-assessment, perceived competence, can limit future choices.

Question: Do females report being less competent than males?

Data: Females less confident and feel less encouraged by teachers than males ($p < 0.05$).

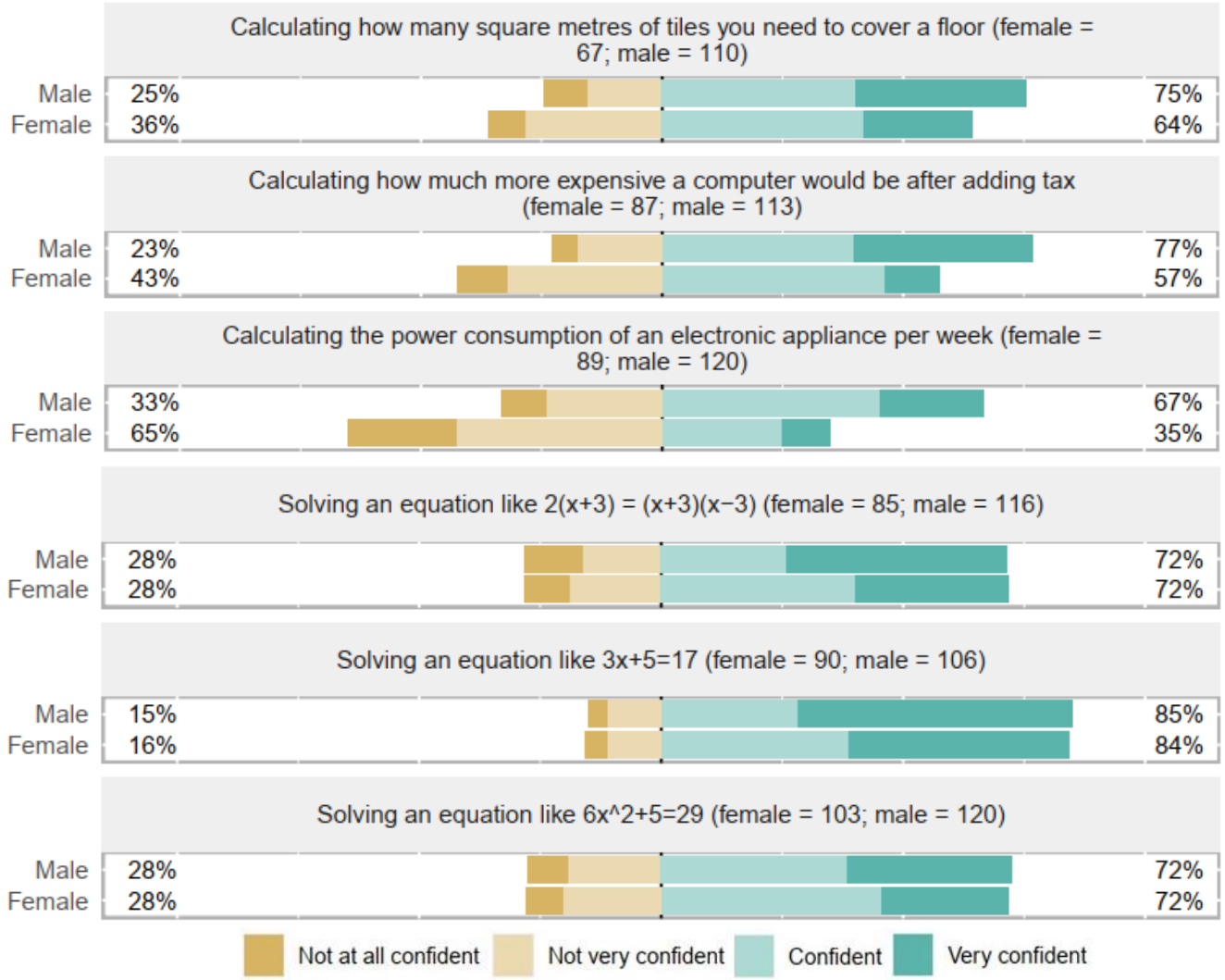
Females are less likely to believe mathematic ability can be improved through effort ($p < 0.005$)

Two issues with this at a gender level, however:

1) Responses have historically shown to have gender bias built in as males overestimate their ability (Jerrim, 2019)

2) The survey shows that when questions are explicitly, females are equally confident.

Similar instances exist in ICT questions and perceived ability.



Conclusions: new evidence for existing issues

Good news: Despite self-assessment/survey responses, no statistical difference at gender level and there has been an increase in participations of females in Stem subjects.

Less good news: Mathematics remains a subject with substantially fewer female enrolments (Ofqual 2020). And while work has gone into addressing this, our and other studies continue to show issues (MEI 2016, Golding 2021). This is both an issue of social justice and an economic utility.

Areas for improvement:

Therefore, we present the following suggestions for further reflection and research:

1) Address feelings of lack of encouragement/reinforce result successes

2) Address vicious cycle of anxiety and poor results

3) Further build link between real-world utility and mathematics (perhaps with focus on employment)

4) Address issue of different levels of self-assessment between genders to further understand data we are collecting, and push research forward

Pearson