How motivated are Irish secondary students to study science?

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Rationale

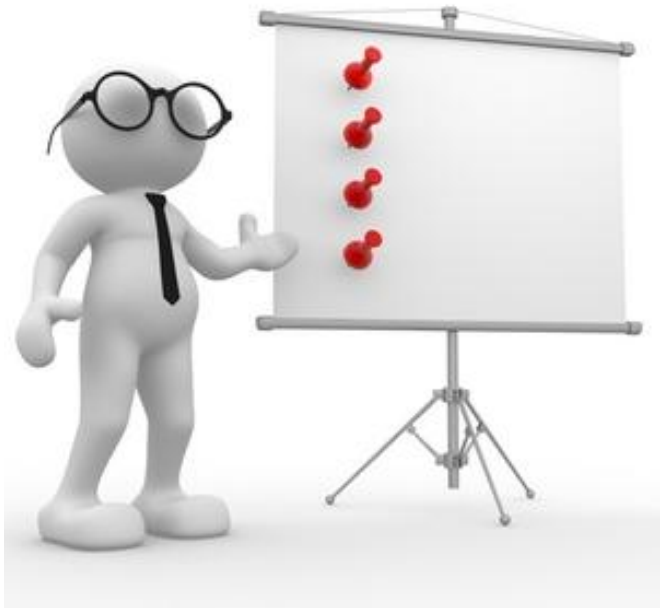
- There has been growing concern for some time about students' decline in interest and motivation to study science at school. There appears to be a "drop-off" from science after the junior cycle with students not opting to study it at senior cycle, particularly the physical sciences.

- Is it possible to identify factors that affect this?

- Can we engage the disengaged?

Structure of Presentation

- Background of project
- Methodology
- Significant findings
- Conclusions
- Future Work



Background to the Project (1)

Too many students are being turned off science too soon!

There are two dimensions to the problem:

1. **Engagement and motivation** – enduring concern that students do not find science at school interesting.
2. **Participation** – once period of compulsory study has ended, decisions are made over subject choices (and students appear to have already "switched-off" by that stage).

(Royal Society of Chemistry 2008)

Background to the Project (2)

- The Relevance of Science Education (ROSE) project report indicates that school science fails in many ways – "school science is less interesting than other subjects" (Sjøberg and Schreiner 2010).

- 2nd year students in Ireland (13-14 years of age) report that they like subjects where the learning is organised in an active, project-like way – but science was not listed as one of these subjects (Smyth *et al.* 2006).

Background to the Project (3)

- Young students enter secondary school with positive attitudes towards science, however, this declines most sharply between the ages of 11 and 14 (Bennett and Hogarth 2009).

- Trends in International Mathematics and Science Study (TIMSS) 2011 report:

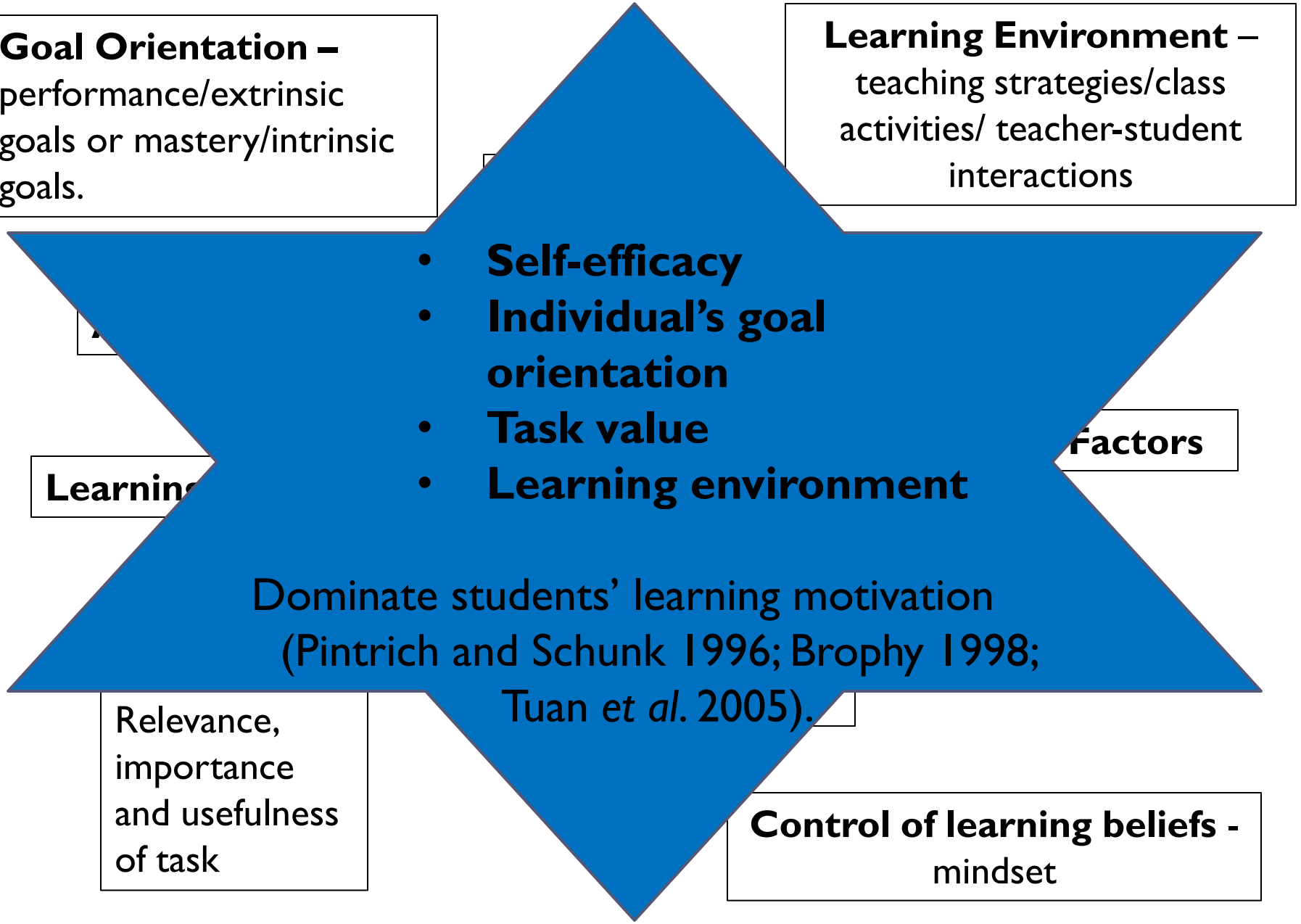
4th Grade (9-10yrs)	Like Learning Science	8th Grade (13-14yrs)
53% agree	→	**35% agree**

Background to the Project (4)

- 2nd year (13-14 years of age) is the **critical point** in Ireland where students either engage/disengage from schooling – marked gender differences here where males tend to disengage moreso than females (Smyth 2009).

What do we know about motivation?

'Catch-all' term – interest, fun, enjoyment and engagement.


Goal Orientation – performance/extrinsic goals or mastery/intrinsic goals.
Learning Environment – teaching strategies/class activities/ teacher-student interactions
Self-efficacy
Individual's goal orientation
Task value
Learning environment
Factors
Learnin
Dominate students' learning motivation (Pintrich and Schunk 1996; Brophy 1998; Tuan et al. 2005).
Relevance, importance and usefulness of task
Control of learning beliefs - mindset

Why is motivation important?

It also plays an important role in:

- Students' conceptual change process (Lee 1989, Pintrich *et al.* 1993, Lee and Brophy 1996).
- Critical thinking and learning strategies (Garcia and Pintrich 1992, Wolters 1999, Kuyper *et al.* 2000)
- Science learning achievement (Napier and Riley 1985).

How do we measure motivation

- Not directly observable – difficult to quantify it – not a unitary phenomenon.

- Motivation is content specific - researchers have stressed the importance of investigating students' motivation **when studying specific subject content** areas (Blumenfield and Meece 1988; Weiner 1990; Blumenfield 1992, Lee and Anderson 1993; Lee and Brophy 1996).

- Self-report measures tend to produce **generalised responses** and may be **developmentally inappropriate** for young people (Tuan *et al.* 2005).

Science Motivation Questionnaires

- **MSLQ** (Pintrich *et al.* 1991) was designed to assess third-level students' motivational orientations and learning strategies.

- **MoLE** (Bolte 2006) examines the difference between students' REAL and IDEAL learning environments in their science classes.

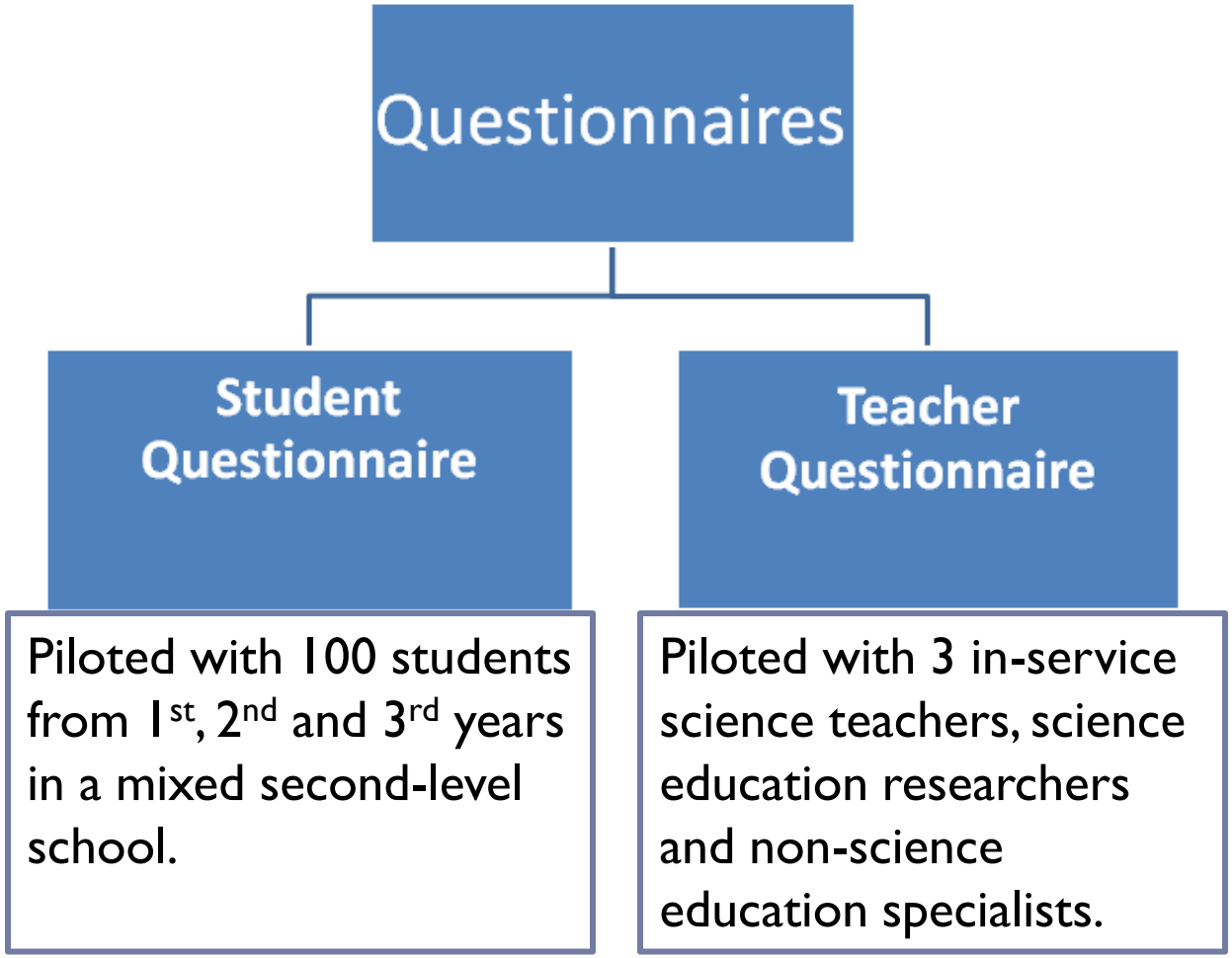
- **SMTSL** (Tuan *et al.* 2005) used to investigate student learning motivation in second-level science.

Research Questions for My Project

- What factors affect student motivation in lower secondary science from the perspective of both students and teachers?

- If students' motivation in lower secondary science does decline, at what stage does this happen?

Methodology



Sampling

- 100 schools were chosen using a stratified sampling approach (Munster region acted as sampling frame – it makes up 29.4% of the total sample in Ireland and is representative of the total).
- 3 teacher questionnaires were sent to each school.
- Confirmation of:
    1. Involvement of students
    2. Number of students

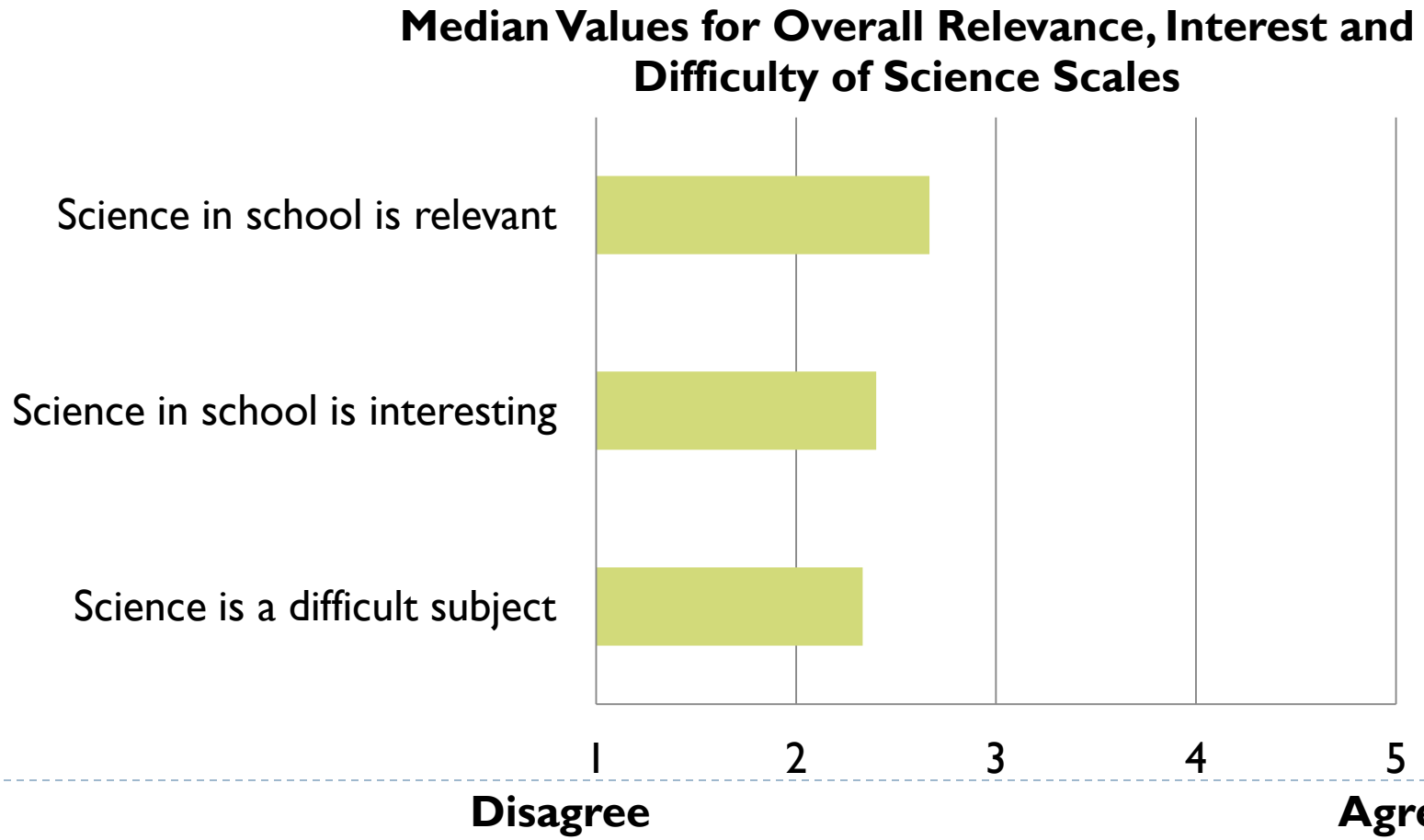
  was required before sending out student questionnaires.

Nature of the Sample

Breakdown	Total No.	Gender	
Schools	47	All-girls = 10 All-boys = 5 Co-ed =32	Secondary = 24 Vocational = 20 Comm & comp = 3
Teachers	74	Female = 48 Male = 26	~65% ~35%
Students	1427	Female = 758 Male = 662 Missing = 7	~53% ~46.5% ~0.5%

Student Questionnaire: Results (1)

- Generally, lower secondary science students do **not** find science in school relevant, interesting or difficult (n= 1427).



Relevance

Students' opinions about the "**point of studying science in school'** differed significantly depending on the **year** group (p=0.001).

The older the year group, the less the "point of studying science in school".

Interest

Students who feel that they "**would enjoy school more if there were no science classes"** differed significantly with **year** group (p=0.001)

The older the year group, the more they agreed with the statement.

No sig. diff. between year group and how **boring** students find science class (p=0.738).

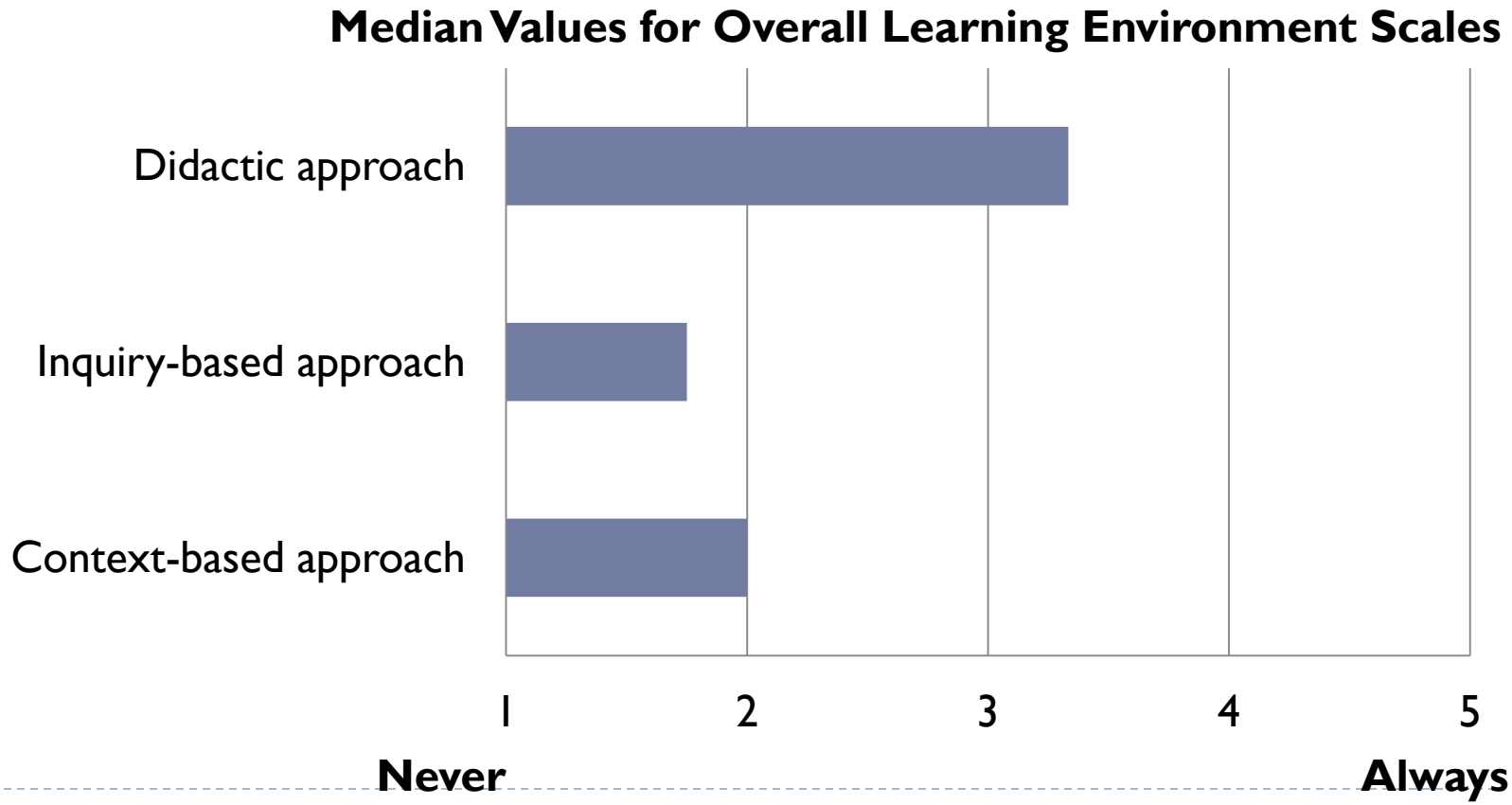
Difficulty

Sig. diff between **year** group and students of the opinion that "**science is a difficult subject"** (p=0.005).

Most difficult	1st Year
	3rd Year
Least difficult	2nd Year

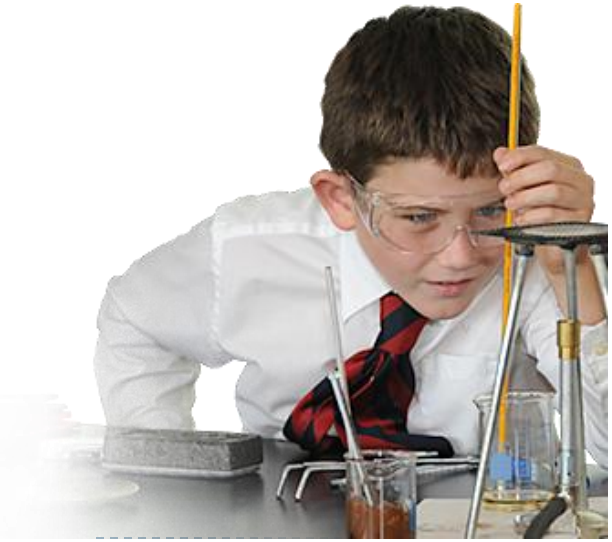
Student Questionnaire: Results (2)

- Students are most exposed to didactic learning environments (n= 1427).



1. **80.5%** of students find that most/all science classes are spent **listening** "**to the teacher** explain science ideas" - this does not differ significantly with year group (p=0.146).

2. **37.2%** of students "**think about a science problem before it is explained to [them] by [their] teacher**" in most/all classes - again no sig. diff. with year group (p=0.466).

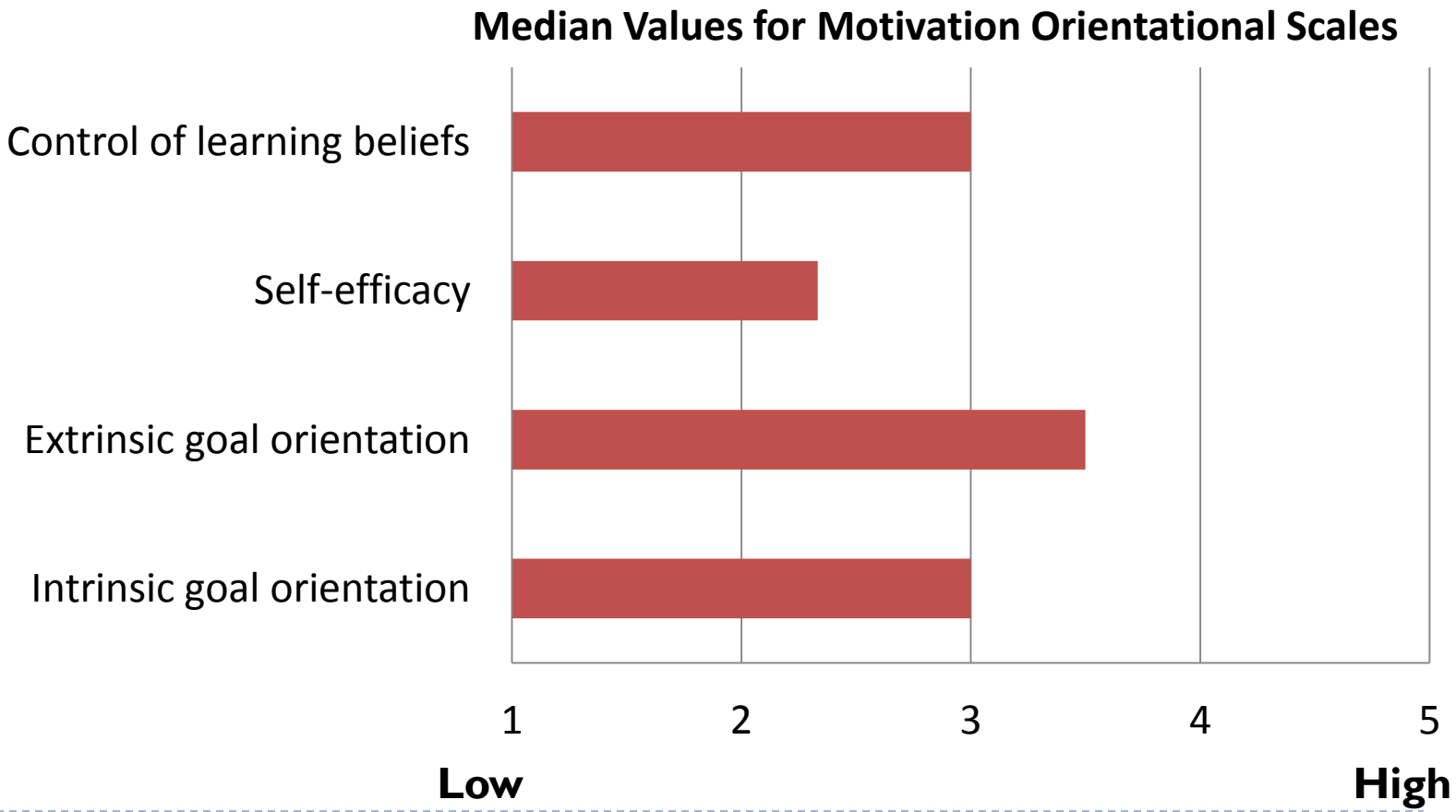


3. **30%** of students "**get the chance to do hands-on, investigating work before looking at the theory**" in most/all classes – does differ sig. with year group (p=0.004).

1st years → 3rd years → 2nd years

Student Questionnaire: Results (3)

- Students show higher levels of extrinsic goal motivation than the other motivational variables. (n= 1427).



EXTRINSIC GOALS

"My main goal in science class is to get a good grade" – **no** sig. diff. with **year group** (p=0.145) or **gender** (p=0.133).

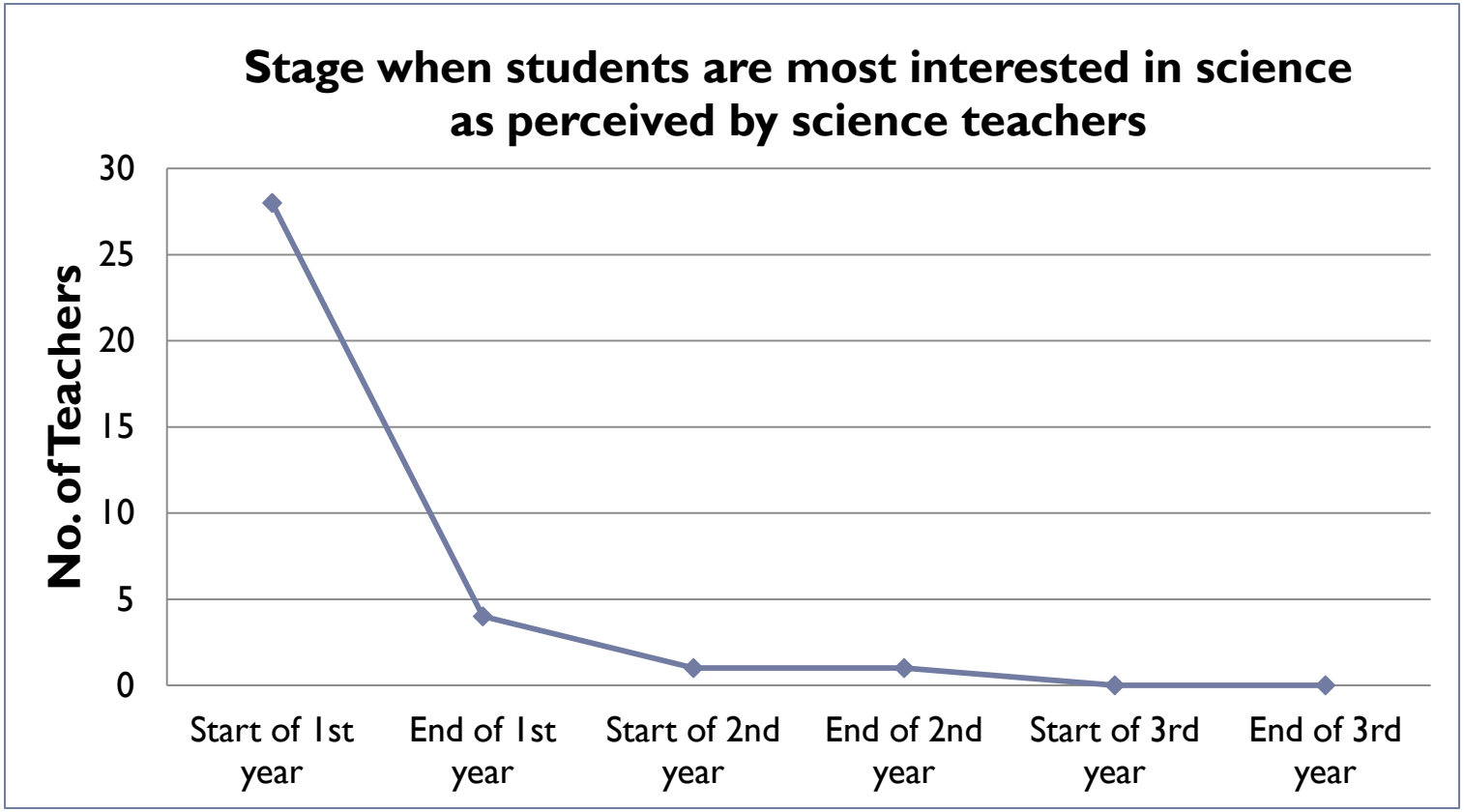
SELF-EFFICACY

"I am not as good at science as most of the other students in my class" – sig. diff. with **gender** (p>0.000).

Males show **higher** levels of **self-efficacy** than females.

Teacher Questionnaire: Results

- The consensus from teachers is that "students' interest in science declines as they progress from 1st to 3rd year".



General Conclusions (1)

- Students' interest in lower secondary science declines with increasing year in school as perceived by students and teachers.

- 2nd year science students (13-14 years of age) find science easier than 1st and 3rd year students.

- Didactic teaching methods do not vary from 1st year to 3rd year - students spend most of their class time "listening to their science teacher".

General Conclusions (2)

- Inquiry-based learning environments (teaching strategies and classroom activities) are observed least often in 3rd year science classrooms (when compared to didactic and context-based environments).

- Lower secondary science students are motivated most by their extrinsic goal orientation – no difference for gender or year group.

- Generally, students show low levels of self-efficacy – but males show higher levels of self-efficacy than females.

Future Work

- Increasing sample size of the teacher questionnaires.
- Qualitative study with teacher interviews and student focus groups from 1st, 2nd and 3rd year groups.
- Critical analysis of the methods of measuring motivation.

Thank you for your attention.

Questions?

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Student Questionnaire Design

Part of Questionnaire	Scales	α
Attitudes towards science	Interestingness of science (5 items)	0.875
	Relevance of science (3 items)	0.659
	Difficulty of science (3 items)	0.817
Teaching approaches used in science class	Context-based approach (4 items)	0.649
	Inquiry-based approach (4 items)	0.582
	Didactic approach (3 items)	0.546
Motivation in science class	Intrinsic goal orientation (3 items)	0.740
	Extrinsic goal orientation (2 items)	0.622
	Self-efficacy (3 items)	0.703
	Control of learning beliefs (3 items)	0.724
Career aspirations in science	Interest in pursuing a career in science (7 items)	0.849