Teachers' interests and concerns related to the teaching of "Responsible Research and Innovation"

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Teachers as learners and innovation adopters

- Teachers are keen learners motivated by personal interests, students' interests and school's interests
- Teacher learning can depend on (1) constructivist staff development (2) opportunities for interaction with colleagues and experts (3) old structures and thought patterns as barriers (4) testing culture (Davis 2003)
- Even after learning, teachers can decide to abandon the innovation

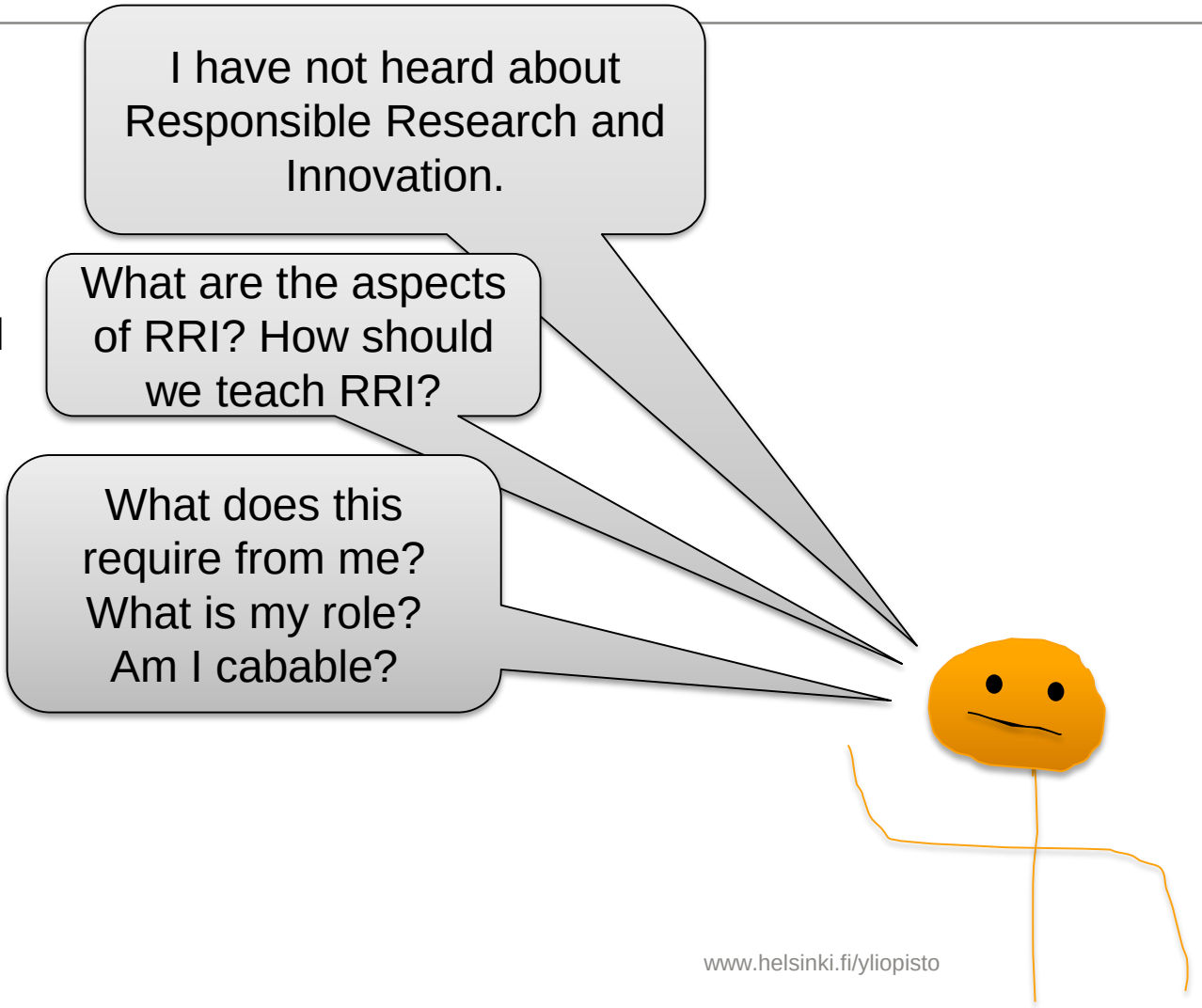
Implementing Responsible Research and Innovation (RRI) in IRRESISTIBLE

- Teachers in an EU project IRRESISTIBLE are incorporating RRI into teaching modules in the following ways…

Engagement	Within IRRESISTIBLE, researchers work with students, teachers and science museum experts. School students are taught about the role of different societal actors.
Equality	Within IRRESISTIBLE, equality is taken into account in teaching methods and in teaching content. Students receive a realistic and diverse impression of scientists.
Science Education	IRRESISTIBLE uses teaching methods, such as inquiry-based learning, to promote interests in science equally.
Open Access	Students are taught about the role of scientific information in society.
Ethics	Ethical issues related to research, the effects of applications on health and the environment and the social acceptability of science.
Governance	For example, students are allowed to 'assume' different roles in society.

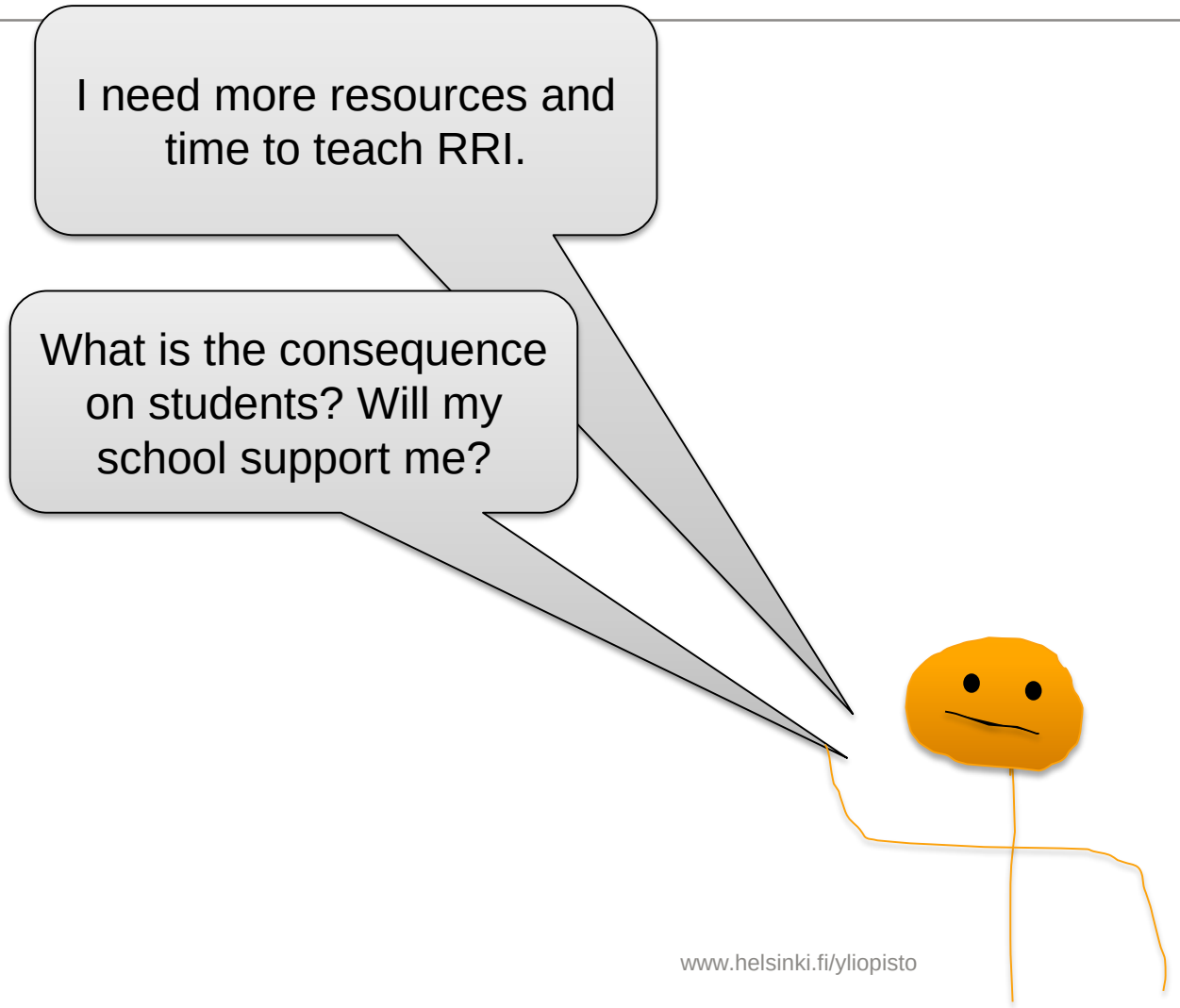
Stages of Concerns-questionnaire: an instrument of Concerns-Based Adoption Model (Hall & al. 1977)

- 0: Awareness
- 1: Informational
- 2: Personal



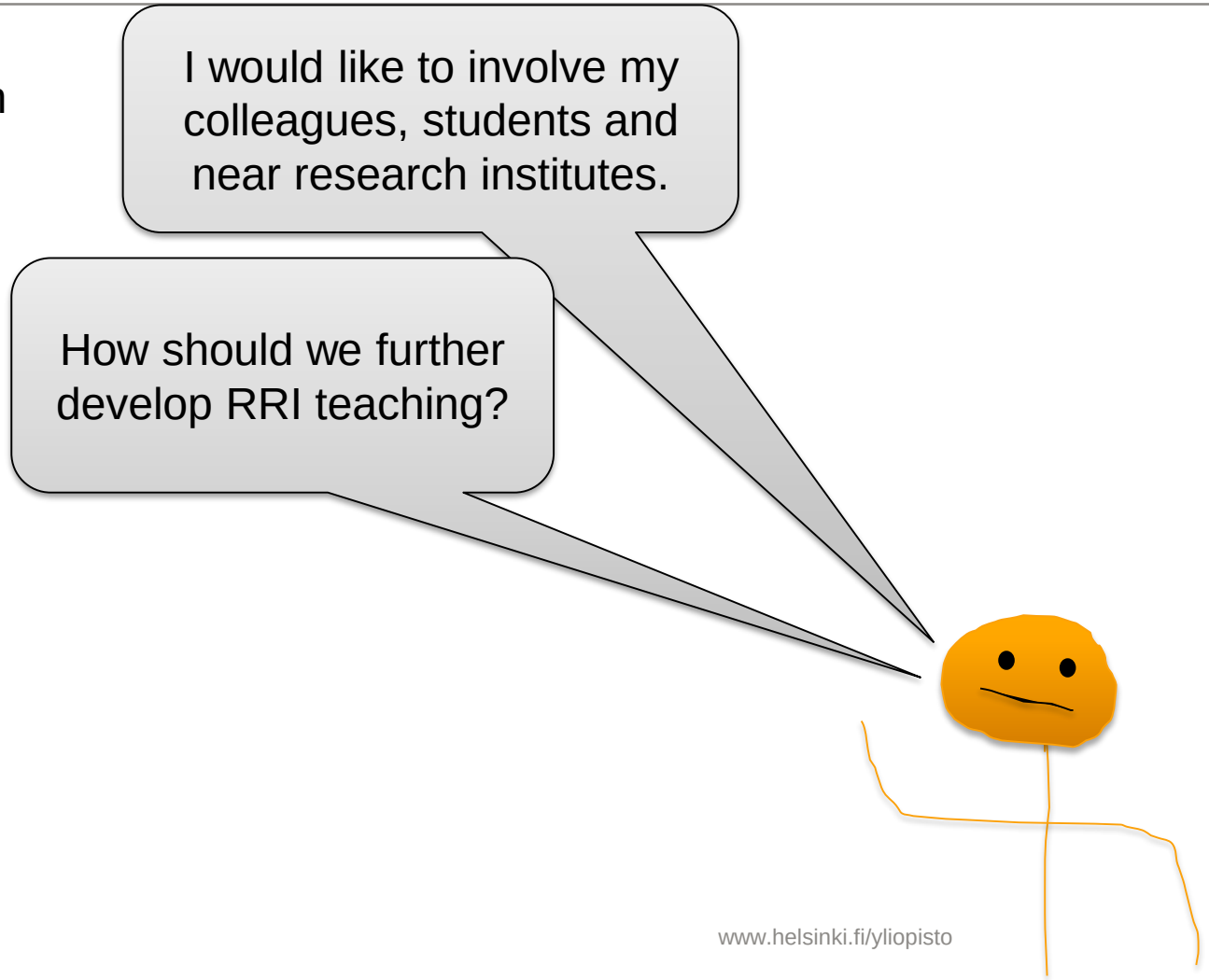
Stages of concerns

- 3: Management
- 4: Consequence



Stages of concerns

- 5: Collaboration
- 6: Refocusing



SoC-profile types

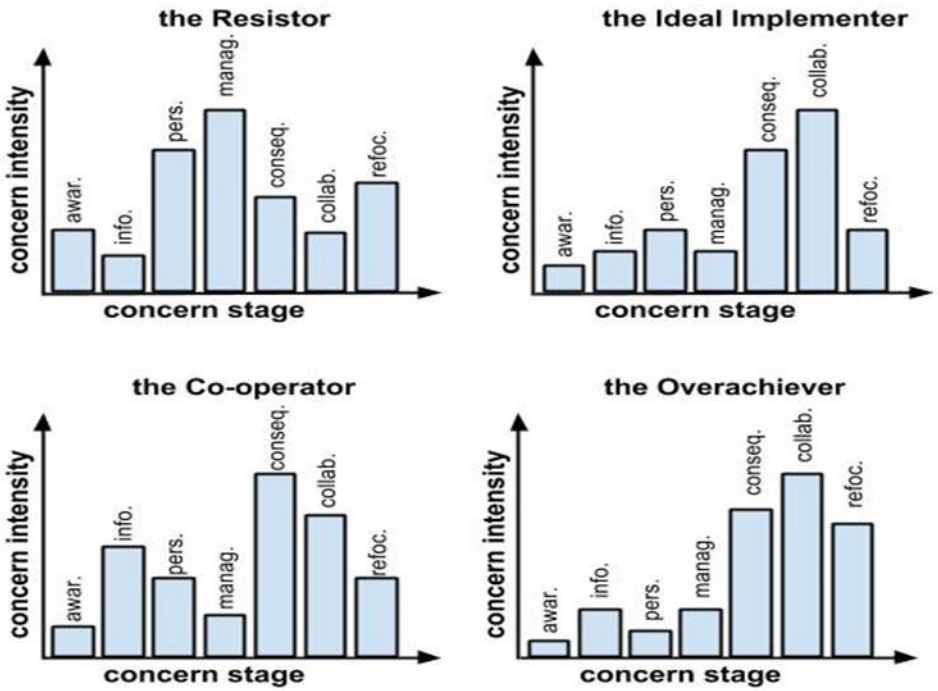
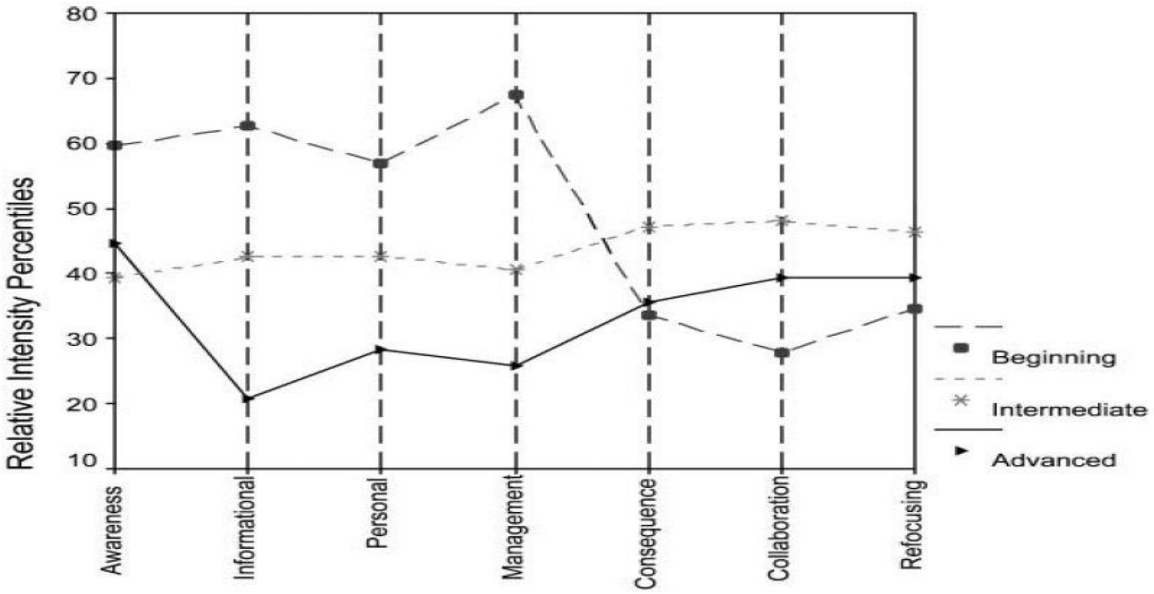


Figure 3 Profile type of a the Resistor, the Ideal Implementer, the Co-operator and the Overachiever (redrawn based on Hollingshead 2009)

Previous studies

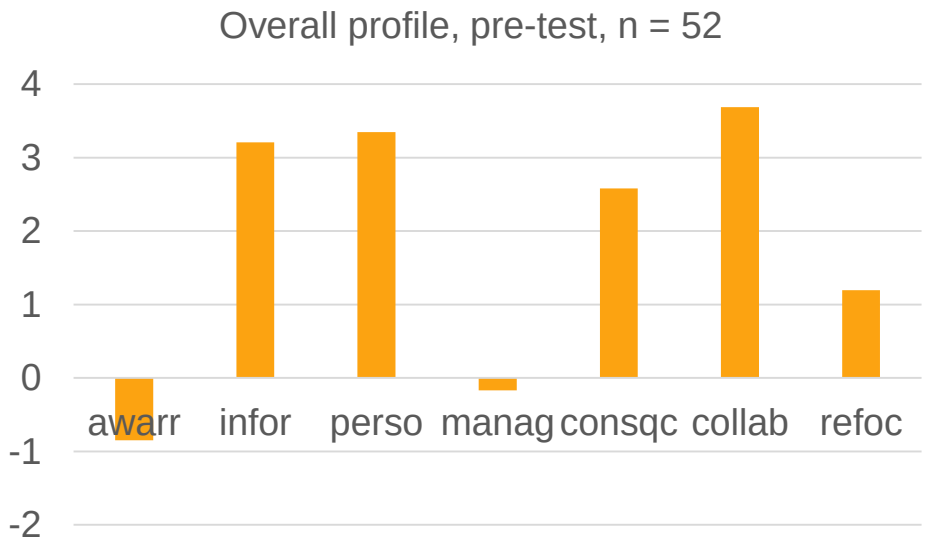


- *Figure 3.* SoC profile of 80 teacher students who participated in a technology integration course (Liu 2005). Low-level stages were resolved.
- Teaching experience had no effect in Shoulders & Myers (2011) research on SoC profile of agriscience teachers

Methods

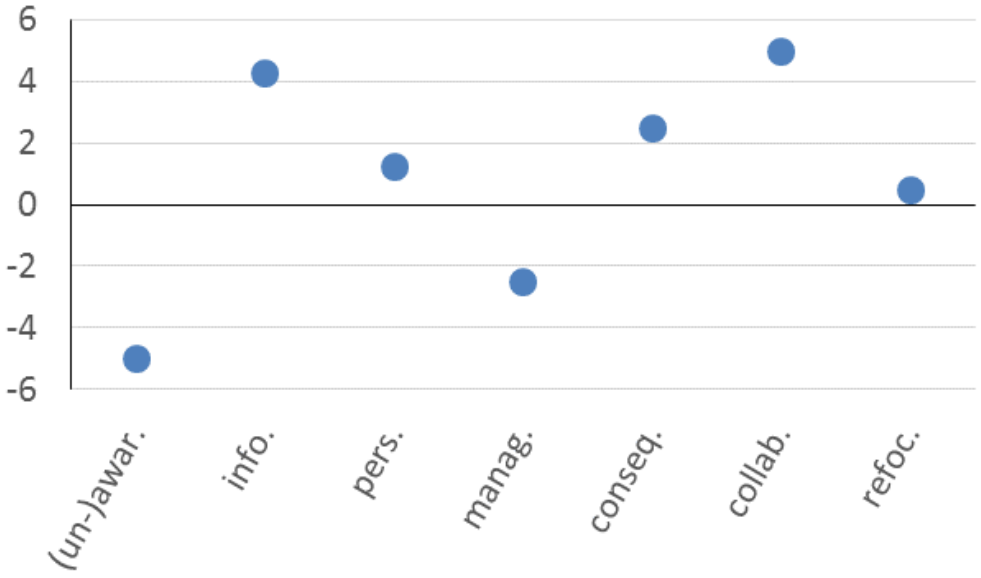
- We studied 52 teachers from 10 countries using Concerns-Based Adoption Model and open-ended questions
- Teachers built teaching modules about Responsible Research and Innovation with the help of experts
- Teachers took 20 minutes to answer an online SoC-questionnaire (33 items) and open-ended questions in their first and last meetings
- Most partners decided to translate the questionnaire

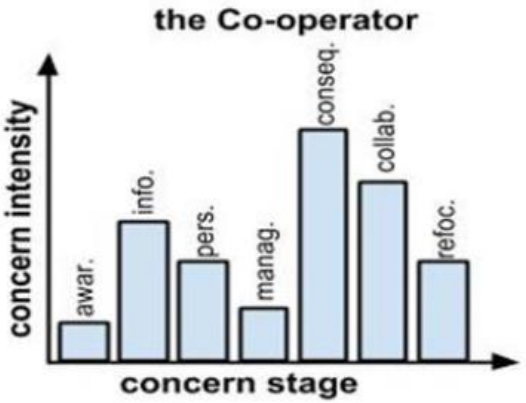
Results



The overall pre-test profile is closest to the Co-operator type
Standard deviations were very high

Results





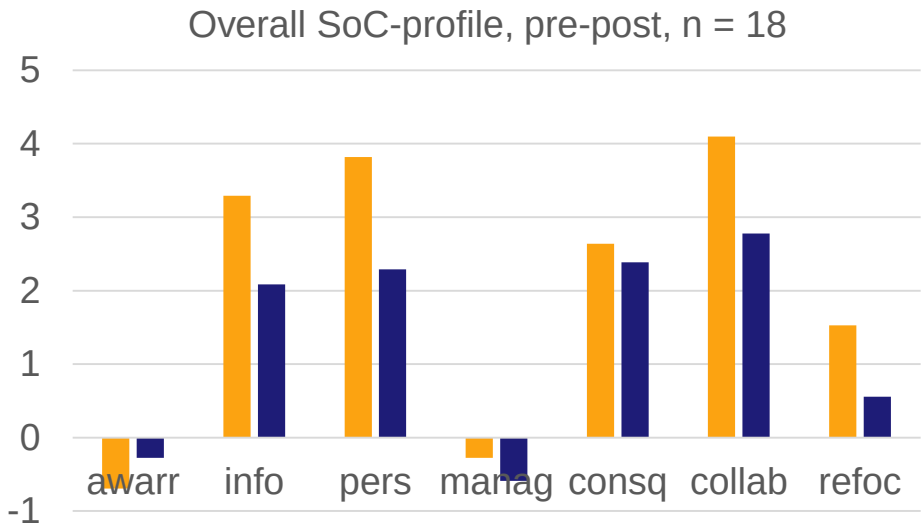
An example of a co-operator profile type found in our study; 14/52 were Co-operators and 22/52 had almost a similar type (info ←→pers). There were no other statistically significant groups.

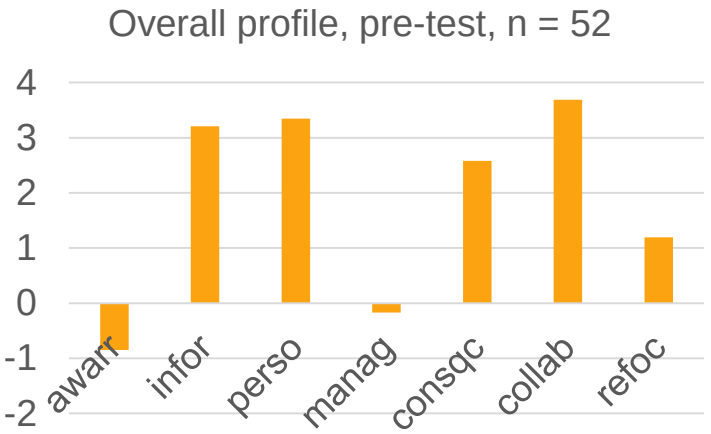
Results: open-ended questions

Expectations from the project

Development of teaching (n=24)	*Development of content knowledge (n=8)*	*Collaborative aspects (n=6)*	*Student engagement (n=7)*	*Promoting themes of the project (n=6)*	*Personal preferences (n=34)*
• Professional development • Growing as a teacher • Effective teaching (n=13)	• Development of content knowledge • New content for teachers and students (n=6)	• Collaborating and contacting with other teachers, teamwork (n=3)	• Engaging and motivating students • Attracting students interest in science • Developing students' competency (n=5)	• Increased awareness • Educating future citizens • Integrating all the projects components into the module (n=4)	• Personal challenge • Interested in new things • Contribution to module development (n=32)
• Learning new and innovative teaching methods • New practice in class (n=7)	• Exploring nano-science, a difficult subject (n=2)	• Practice exchange with European teachers about Responsible Research and Innovation (n=2)	• Designing specific topics that are interesting for students (n=2)	• Learning new and cutting edge science (n=2)	
• Learning to build interactive exhibits • Nice module for schools (n=4)		• Motivating other teachers (n=1)			

Results





- Informational, personal, collaboration and refocusing concerns and interests have decreased slightly.
- Pre-test values are very similar to the whole group of 52 teachers
- However, there are some statistical concerns

Results: Was the change significant?

The change in informational, personal and refocusing stages is <u>almost</u> significant.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of aware is the same across categories of phase.	Independent-Samples Mann-Whitney U Test	,673[1]	Retain the null hypothesis.
2	The distribution of info is the same across categories of phase.	Independent-Samples Mann-Whitney U Test	,091[1]	Retain the null hypothesis.
3	The distribution of pers is the same across categories of phase.	Independent-Samples Mann-Whitney U Test	,091[1]	Retain the null hypothesis.
4	The distribution of manag is the same across categories of phase.	Independent-Samples Mann-Whitney U Test	,767[1]	Retain the null hypothesis.
5	The distribution of consq is the same across categories of phase.	Independent-Samples Mann-Whitney U Test	,673[1]	Retain the null hypothesis.
6	The distribution of collab is the same across categories of phase.	Independent-Samples Mann-Whitney U Test	,152[1]	Retain the null hypothesis.
7	The distribution of refoc is the same across categories of phase.	Independent-Samples Mann-Whitney U Test	,068[1]	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is ,05.

[1]Exact significance is displayed for this test.

Results: Respondents who changed their opinion

5. I have a limited knowledge of RRI.

(-2 = disagree, -1 = rather disagree, 0 = I cannot say, 1 = rather agree, 2 = agree)

		pre-test				
		-2	-1	0	1	2
post-test	-2	1	3	1	**2**	**1**
	-1	0	3	0	**3**	**1**
	0	0	0	0	0	0
	1	**0**	**1**	0	2	0
	2	**0**	**0**	0	0	0

		pre-test				
		-2	-1	0	1	2
post-test	-2	1	2	0	**0**	**1**
	-1	2	2	1	**1**	**0**
	0	0	0	0	0	0
	1	**1**	**3**	1	0	0
	2	**1**	**0**	0	1	1

33. I have learned enough about RRI in my teacher education.

Results: personal and management concerns

7. I am concerned about the need to revise my teaching.

		pre-test				
		-2	-1	0	1	2
post-test	-2	2	1	0	**1**	**0**
	-1	2	2	0	**4**	**1**
	0	0	1	0	0	0
	1	**0**	**0**	1	2	0
	2	**0**	**0**	0	0	1

- Similar reaction to item 13: I am concerned about my ability to manage all that teaching about RRI requires.

Results: interests towards RRI teaching

22. I would like to know what teaching about RRI will require in the immediate future.

		pre-test				
		-2	-1	0	1	2
post-test	-2	0	0	0	**0**	**1**
	-1	0	0	0	**2**	**0**
	0	0	0	0	0	0
	1	**0**	**0**	0	4	1
	2	**0**	**0**	0	1	9

Results

Agreement with the following items decreased slightly…

- 24. I would like to have more information on time and energy commitments required by teaching about RRI.
- 10. I would like to discuss the possibility of teaching about RRI.
- 16. I would like to revise the approach of teaching about RRI.
- 19. I don’t spend much time thinking of teaching about RRI
- 25. I would like to determine how to develop the approach of teaching about RRI.

Collaboration interests have also decreased slightly

- 23. I would like to co-ordinate my efforts with others to maximize the effects of teaching about RRI.

Conclusions

- Before the IRRESISTIBLE project teachers had a concern profile of a co-operator (high informational and collaboration concerns). This was also confirmed by the open-ended questions.
- The effect of the project seems subtle, but directions of the changes are coherent
  - Personal and management concerns have been resolved to some extent, collaboration concerns and interest towards RRI teaching decreased with some of the respondents

Conclusions

- Teachers have a need for collaboration and they want to learn and develop themselves as teachers.
- Teachers are interests in acquiring new knowledge, networking with their colleagues, and giving their students positive experiences about science
- We must support teachers interests and try to find ways for long lasting effects of a PD program.

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