

# Challenge-based learning: how do students perceive the impact of external experts on their critical thinking?

## What do experts and tutors gain? And how do they perceive their contribution to student learning?

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### Context

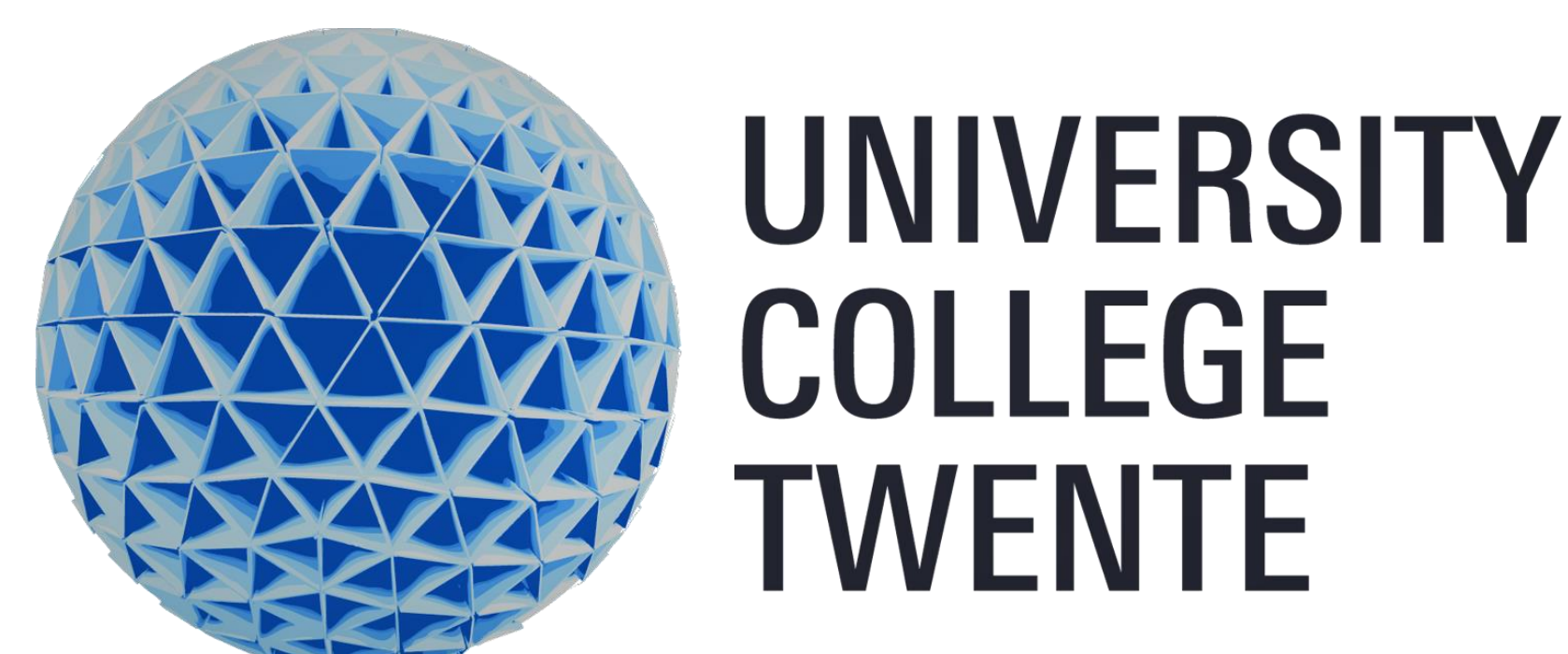
This research project focused on the semester 2 project of the UCT-ATLAS program (2021 – 2022) and involved 28 first-year students, 5 ATLAS tutors, and 6 experts from academia and industry. The project theme was “Sustainable Oceans” and the assignment for the students was to write a short-term and long-term socio-technical scenario for an emerging technology related to the theme.

### Research questions

- To what extent do skills in critical thinking develop in students as a result from interaction with external experts? And what do students see as added benefit of expert involvement?
- What do external experts gain from the CBL experience and how do they think they contribute to the students’ learning?
- What do tutors gain from the CBL experience and how do they think they contribute to student learning?

### Methods

Critical thinking activities (assumption recognition, argumentation, evaluation and decision making) were derived qualitatively from students-expert meeting protocols. In addition, self-report measures from surveys (halfway and at the end of the project) and focus group data were used. Data from experts and tutors were collected via interviews.



### Protocol analysis and survey results

#### Critical thinking:

Per meeting, range of mean number of Critical Thinking Activities (CTAs) summed across different CTA categories was 3 – 5.5 (very low)

However, survey data showed the following pattern:

	Halfway project		End project	
	Mean (SD)	N	Mean(SD)	N
1 = totally disagree 5 = totally agree				
“The expert supported my team in recognizing and addressing assumptions”	3.8 (1.05)	16	3.9 (.70)	15
“The expert supported my team in building arguments using literature, logic, and base knowledge.”	4.1 (1.02)	16	4.1 (1.0)	15
“The expert supported my team in evaluating claims; discussing ideas to see the arguments in favour and against these ideas”	3.7 (.87)	16	3.8 (1.0)	15
“The expert supported my team in making decisions based on ideas discussed”	3.9 (.96)	16	3.4 (1.2)	15

### Focus group results students

Students felt the experts **broadened their perspectives** on their topic:

*“You don't know because when you have a new subject, you don't know what you don't know. And experts can then say, Hey, this is something you don't know. “*

Students appreciated that they could **ask questions**:

*“But by asking the right questions, you can get an expert to just go on and on and on about a subject. And I think that was very valuable because then you pick up parts of the market that you don't really think of or expect. And that was very valuable and valuable in our case.”*

In preparing for the expert meetings students **felt stimulated to think more deeply** about their topic:

*“And so it even without actually having to have any meetings whatsoever, you do somewhat start thinking about the ways in which you are presenting your arguments and the ways in which you evaluate and make decisions because you will be presented as someone who is very knowledgeable.”*

### Interview results experts and tutors

Expert gains: **Content Learning.**

*“I think I like the fact that the sort of technology that was a bit of an outsider. So they challenged me as well because I didn't know about these renewable technologies and stuff like that .”*

Contribution to student learning: **Broadening Perspectives** of students and **Supporting Critical Thinking.**

*“I think the other advantage that we could possibly introduce to the team is to perhaps give a perspective of what the business will look at.”*

*“I do recall on many occasions I do ask them to rethink their assumptions because I found it more constructive than to tell them that the assumptions are not correct.”*

Tutor gains: awareness of **Balance between Scaffoldingg and Freedom**

*“ ... by giving not too much scaffolding, but enough to be able to have some room to move and then and then wait, sit in your hands and wait for students to move. “*

Contribution to student learning: **Monitoring progress** and **Product Feedback**

*“I was always, you know, monitoring the process. And you'll have us somewhere in between and also making sure that they would deliver a proper deliverable.”*

*“So it's more like giving more feedback or providing feedback for the students on their submission. I think that's mostly what I contribute.”*

### Conclusions

Students perceive the experts foster their critical thinking, they appreciated that they could ask questions and felt stimulated to think more deeply about their topic. Especially, experts broadened their perspective on the topic. Experts felt they could support students in their critical thinking. Tutors valued the inclusion of experts and became aware of the delicate balance between providing scaffolds and freedom on the students’ part.

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