Evaluation of the AILO Programme 2019/20

Executive Summary

The Education and Public Engagement programme of the Science Foundation Ireland Research Centre for AI Driven Digital Content Technology, ADAPT, aims to empower the Irish public to engage fully in our rapidly-evolving digital landscape and to foster an interest in, knowledge of, and appreciation for the emerging technologies driving change in digital media and technology.

ADAPT has identified 'collaborative and creative problem-solving' as a key skillset to leverage digital media innovations and to enhance how we interact with future digital media and information. The ADAPT EPE Learn strand aims for Second level education are:

- Enhance students' problem-solving skills and increase their confidence in tackling complex problems.
- Ensure that talented young problem-solvers see clear links between their love of problem solving and STEM career pathways.

In late 2017 ADAPT conducted a study on how the AILO learning outcomes align with the Junior Certificate (JC) Programme (ages 13-16 years old) for Maths and Coding, and with the OECD PISA (2012/2015) collaborative and creative problem-solving competencies. Since then an analysis of the links with the Modern Foreign Languages (MFL) curriculum has also been carried out (Appendices C and D).

Over 3500 students from over 150 schools were registered for AILO, including 750 students from 35 disadvantaged (DEIS) schools. The gender breakdown for participation was 52% female, 48% male. This evaluation report focuses on the following interactions:

- AILO Problem-solving Workshops Nov 2019 – Jan 2020

Twenty-nine workshops, attended by 812 students and their teachers from 65 schools, were run by ADAPT tutors held in 17 counties all over the island of Ireland. The workshops were evaluated through attendee post-event questionnaires.

• AILO Preliminary Round February 2020

The principal challenge encountered with AILO 2019 was the resource-intensive nature of marking the 1,350 five-question papers of preliminary round participants. ADAPT therefore developed an online preliminary round with majority automated marking. This was rolled out successfully in January 2020 following two internships in Summer 2019. Bronagh Carolan and Chihun Lee joined ADAPT for eight weeks to develop 'AILO Online". Bronagh was a former AILO student herself, and went on to study Computer Science and Language/Linguistics at TCD during which time she joined ADAPT as an intern. These internships included a practise area for students, an October pilot round and initial technical set up for the January round. AILO Online was rolled out successfully in January 2020.

One challenge for some schools was access to computing facilities so some schools still did the printed paper. 1100 students took the online preliminary round of AILO "AILO Online" all

over the country in their own schools under teacher supervision. The preliminary round was evaluated through attendee online post-event questionnaires.

• AILO National Final March 2020

The top 100 students from the preliminary qualifying round were invited to the National Final of AILO on Wednesday 11th March in Dublin City University. Due to Covid-19, the National Final, due to place in DCU, was reworked with two days' notice to run remotely in schools just before they closed. As schools closed the next day, very limited surveys were emailed in, and so that National Final evaluation is not included in this report.

The top four performers from this were due to progress and represent Ireland at the International Linguistics Olympiad 2020 in Latvia but this was cancelled due to COVID-19. Additionally, more than 4,500 people downloaded AILO puzzle packs from the Olympiad website during 2019/2020.

Overall feedback indicated that the workshops and AILO Online preliminary round were well-received, well-organised and that participants would recommend AILO events to others.

The key outcomes from the evaluation were:

- Participants reported improved confidence in their problem-solving skills as they continued through the programme.

- Participants reported improved effectiveness in tackling complex problems.

- Participants reported an improved propensity to study computing, languages or linguistics at third level as they continued through the programme.

- Those that attended workshops were more likely to reach the AILO National Final

- Participants reported improved skills they can use in other aspects of the lives.

AILO has been awarded the prestigious 2020 European Language Label (ELL) for the 'AILO at Home' project. 'AILO at Home' was devised just after secondary schools closed in March 2020. Its aim was to continue to communicate with AILO students and their parents, and to engage with the wider public. The initiative provides bite-sized information on a little-known language on social media and links to a related linguistic problem-solving puzzle. The initiative scored highly in the ELL evaluation, with 14 points out of 15.

The jury considered the project "*in a class of its own*" and commended 'AILO at Home' for its "*quantum leap*" over just a few months. Referring to AILO's "*very successful transition to online AILO*", the award highlights how AILO pivoted to running online during the COVID-19 lockdown, with students doing the competition remotely for the first time. Building on the move online in the new school year, ADAPT researchers will run free online problem-solving

workshops in order to help students and teachers with problem-solving strategies and prepare them for AILO 2021. The new season will be able to run fully online if necessary and students will be able to take part in all parts of the competition from their own schools.

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1. AILO Overview

The All Ireland Linguistics Olympiad (AILO) is the problem solvers' challenge. The national contest sees secondary school students develop their own strategies for solving complex problems in unfamiliar languages from around the globe. No prior knowledge of linguistics or foreign languages is required. Even the hardest problems require only logical ability, patient work and a willingness to think around corners.

AILO introduces students to the application of logic and linguistics to problems of language understanding and translation. The goal is to develop students' problem-solving skills, improve confidence and to inspire them to consider the fascinating range of careers at the intersection of computing, language and linguistics.

AILO is run by the Science Foundation Ireland Research Centre for AI Driven Digital Content Technology, ADAPT, a multidisciplinary academia-industry research centre comprising 150 researchers at Trinity College Dublin, Dublin City University, University College Dublin and Technological University Dublin, AIT and CIT.

Each year, approximately 4,000 secondary school students, North and South, register for AILO to receive monthly sample puzzles. Students are then invited to free regional workshops held all over the island. Approximately 1,200 students take the preliminary round in their own schools each year in February and the top 100 are invited to the National Final in March in an ADAPT university. The top four problem-solvers go on to represent Ireland at the International Linguistics Olympiad (IOL) each Summer, bringing home bronze medals in the past.

2. Background

The Programme for International Student Assessment – PISA 2012 (OECD, 2014) ranked Ireland's 15-year olds at 22nd of 44 countries in computer-based problem solving. This mediocre performance suggests that Ireland needs to act to improve the human capacity of its future workforce in problem solving.

ADAPT has identified 'collaborative and creative problem-solving' (OECD, 2017) as a key skillset to help secondary school students to leverage digital media innovations and to enhance how we interact with future digital media and information. The changing nature of the future of jobs highlights a need for core transferable skills like adaptability and problem solving. The OECD, for example, in explaining its focus on assessing students' problem-solving skills across the globe, explains that: "Schools need to prepare students for change that is more rapid than ever before, for jobs that have not yet been created, for societal challenges that we can't yet imagine, and for technologies that have not yet been created." The World Economic Forum's Future of Jobs Report (WEF, 2016) report states that: "65% of children entering primary school today will ultimately end up working in completely new job types that don't yet exist."

While student views of problem-solving ability were assessed in the AILO programme in 2016, an analysis of student problem-solving skills was carried out after the National Final in 2017. This showed that while AILO students were able to see patterns and trends in complex puzzles, improvement was needed in representing those ideas clearly and accurately.

Learning outcomes for what students should be able to do after each round of AILO were set out and compared with the OECD PISA (2012/2015) collaborative and creative problem-solving competencies (Appendix C).

This was followed by an analysis of how the AILO learning outcomes support the Junior Certificate (JC) Programme (ages 13-16 years old). Specifically, the learning outcomes were matched against the following elements and are available in Appendix D.

a. Junior Certificate Key Skills

b. Junior Certificate Statements of Learning (SoL)

c. Maths / Coding / Modern Foreign Languages curricula

3. Overview of AILO 2019/20 Statistics

AILO Problem Solving Olympiad Workshops 2017	No.	Information
Registered & received sample puzzles - students	3500	
Registered & received sample puzzles - teachers	145	
Number of students from disadvantaged schools registered (DEIS)	720	from 35 schools
Regional Workshops Student Attendance	812	29 workshops held in 17 counties (65 schools from 21 counties)
Low STEM-engagement counties	7	7/8 counties acted as hosts for workshops
Teachers at workshops	30	
ADAPT Regional Workshop tutors	20	
Round One 52% female, 48% male	1100	
Round Two 52% female, 48% male	100	
International Linguistics Olympiad (IOL) level	4	Four qualified but the IOL was cancelled.

4. The 2019/20 Workshop Programme Overview

The 2019/20 workshop programme covered:

- ADAPT researcher education and career background

- Why problem-solving skills are important

- Introductory logic puzzles

- Introduction to AILO & problem-types

- How to analyse data and tools to use (e.g. tables, graphs, colours)

- How to explore ideas and alternatives, how to find patterns.

- How to write clear and concise rules to describe your findings

- Practice with a preliminary round puzzle

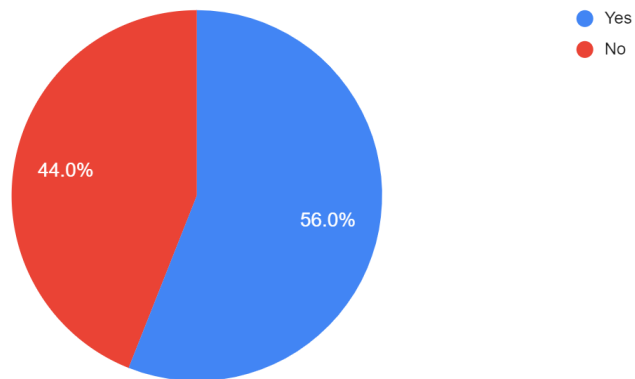- Practice with a National Final round puzzle

Puzzles and workshops can be found at https://ailo.adaptcentre.ie/sample-puzzles/.

5. November 2019 – January 2020 Post-Workshop Survey Results

Respondents: 283, survey in Appendix A.

Had you considered studying computing, languages, linguistics/
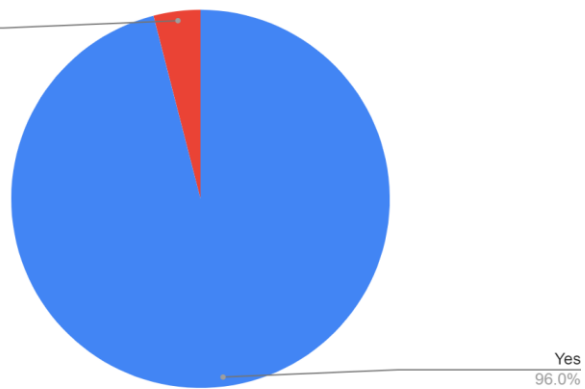STEM at university before today?

283 responses

● Yes
● No

44.0%

56.0%

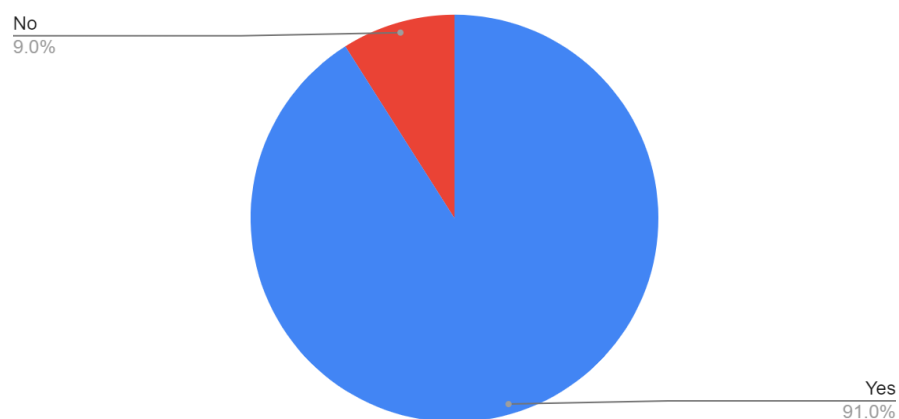Would you recommend AILO to a friend?
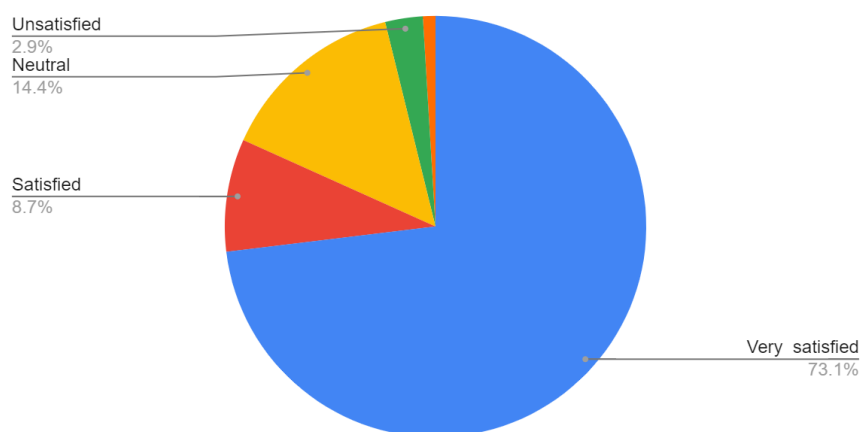
283 responses

No
4.0%

Yes
96.0%

Would you like to take Round 1 of AILO in your school at the end of January?

283 responses

No
9.0%

Yes
91.0%

What is your overall assessment of the workshop today?

283 respondents

Unsatisfied
2.9%
Neutral
14.4%

Satisfied
8.7%

Very satisfied
73.1%

Would you consider studying computing, languages, linguistics/ STEM at university?

283 responses

- Yes
- No

25.0%

75.0%
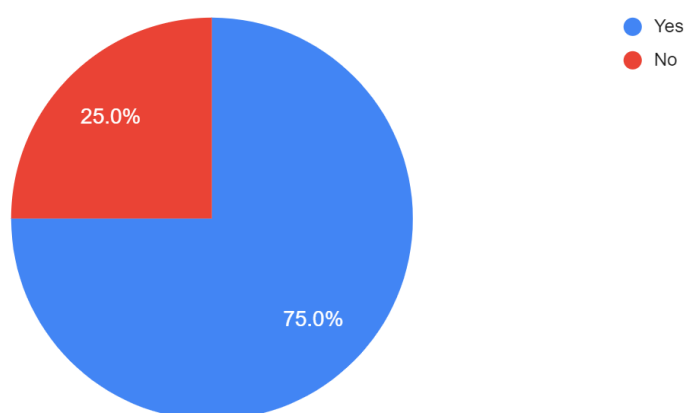
What topics or aspects of this workshop did you find most interesting / useful?
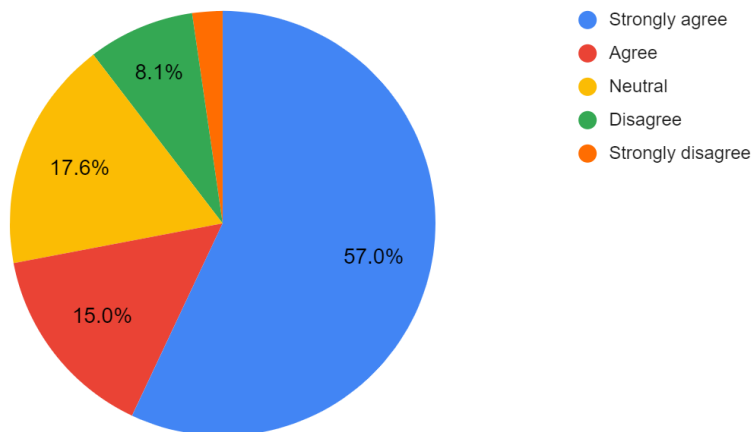
Trying different puzzles

How to solve

Seeing new languages

How much do you agree / disagree with the following statements?

I have effective strategies for solving complex problems

283 responses

●	Strongly agree
●	Agree
●	Neutral
●	Disagree
●	Strongly disagree

8.1%

17.6%

57.0%

15.0%

I am confident in my current problem solving skills

283 responses

●	Strongly agree
●	Agree
●	Neutral
●	Disagree
●	Strongly disagree

8.3%

19.7%

51.0%

19.0%
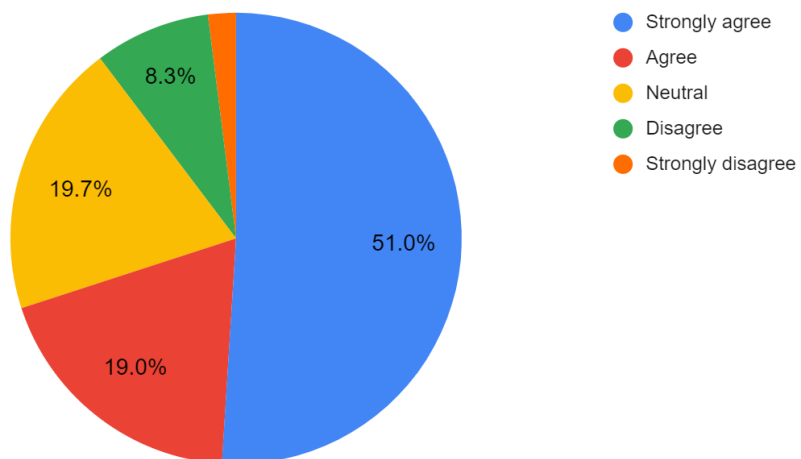
I learned strategies for solving puzzles in this workshop
283 responses

Strongly agree	79.0%
Agree	11.0%
Neutral	8.0%
Disagree	
Strongly disagree	
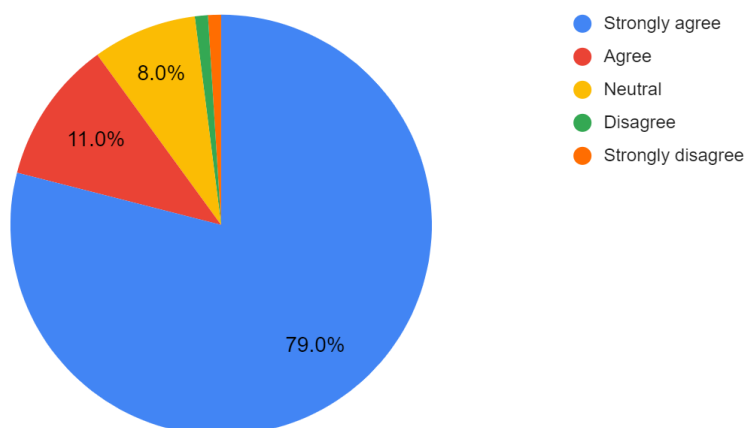
I would recommend this workshop to a friend
283 responses

Strongly agree	93.0%
Agree	
Neutral	
Disagree	
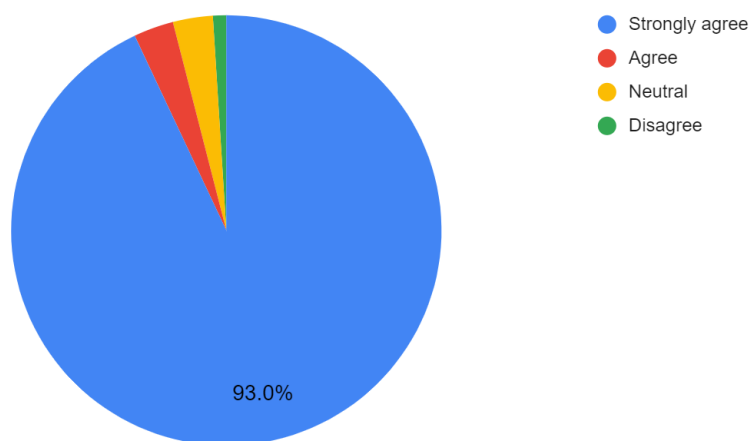
Comments / Feedback

Needs more time.

Really great workshop, thanks

Enjoyed the extra puzzles

More time on puzzle-types

Enjoyed that.

Puzzles not as hard as last year.

6. Post Preliminary Online Round Survey Results 2020

Did you try sample puzzles prior to taking the Preliminary Round in your school?
531 responses

Yes
No

26.4%

73.6%
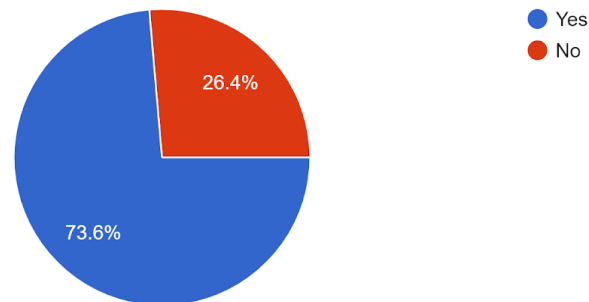
If Yes how useful were they?
418 responses

Very useful
Useful
Average
Not useful
Not at all useful

29.4%

14.8%

46.9%

If Yes, how often did you use puzzles?
418 responses

Daily
Weekly
Monthly
Once-off

43.5%

18.2%

35.9%
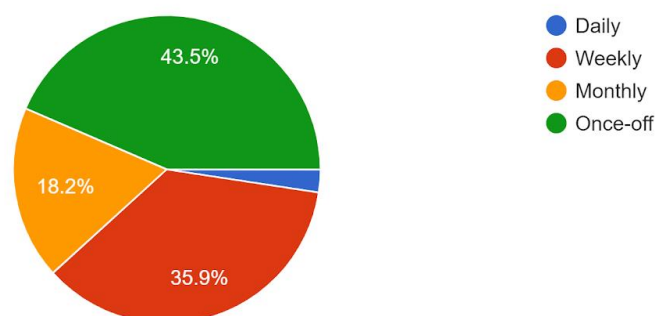
Did you attend an AILO workshop in your school/elsewhere?

531 responses

- ● Yes
- ● No

53.1%

46.9%
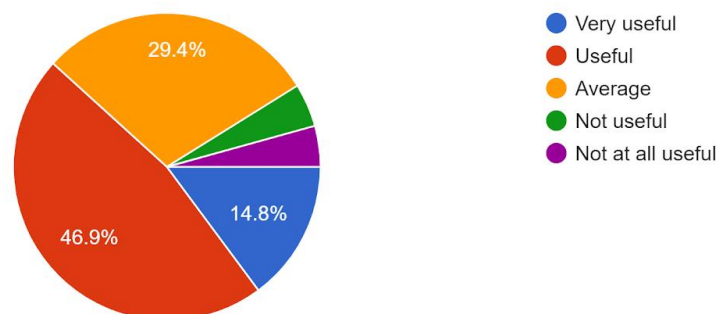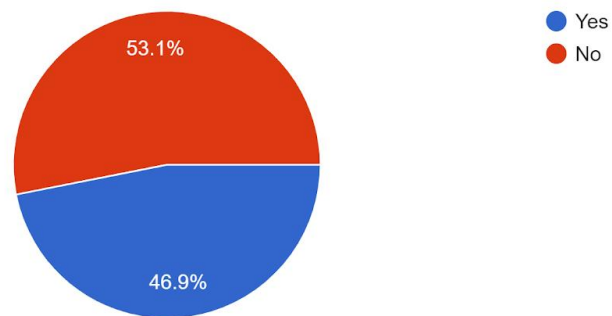
if yes, how useful was it?

303 responses
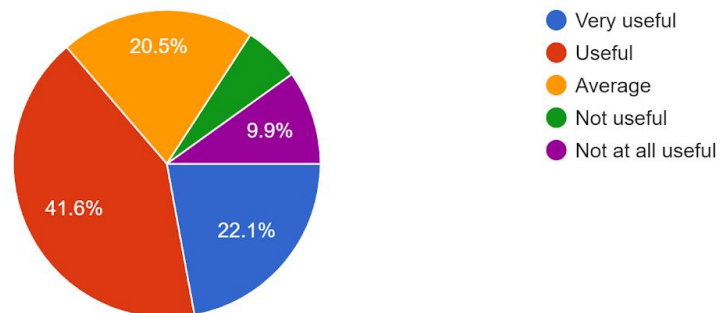
- ● Very useful
- ● Useful
- ● Average
- ● Not useful
- ● Not at all useful

20.5%

9.9%

41.6%

22.1%

Do you agree with the statement: I can see a link between problem solving and careers in Science, Technology, Engineering and Computing (STEM)?

531 responses
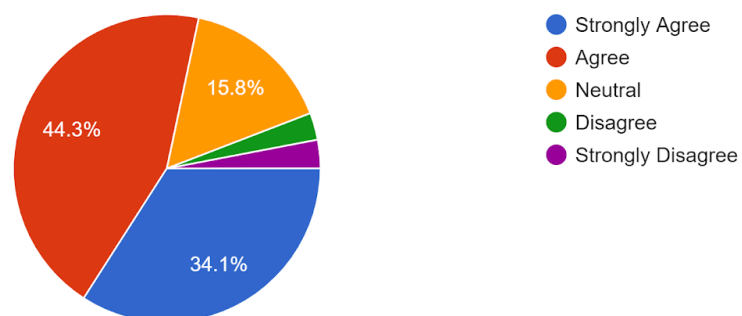
- ● Strongly Agree
- ● Agree
- ● Neutral
- ● Disagree
- ● Strongly Disagree

15.8%

44.3%

34.1%

Before doing AILO, would you have considered studying computing, languages, linguistics or STEM at university?

531 responses

- Yes
- No

44.1%

55.9%

Would you now consider studying computing, languages, linguistics/ STEM at university?

531 responses

- Yes
- No

19.0%

81.0%

Would you recommend AILO as a competition for sharpening problem solving skills?

531 responses

- Yes
- No

7.7%

92.3%
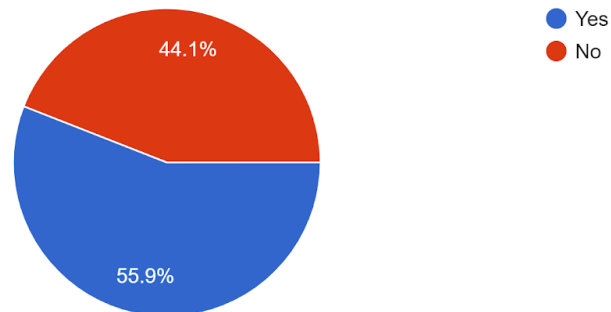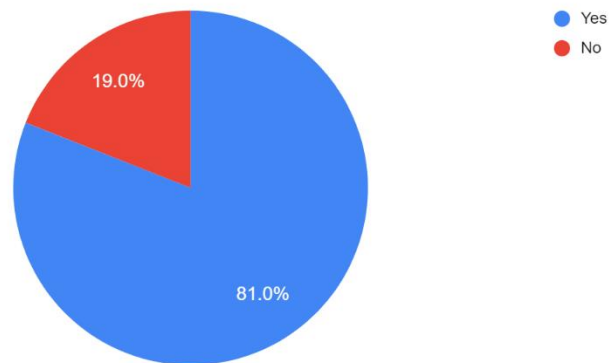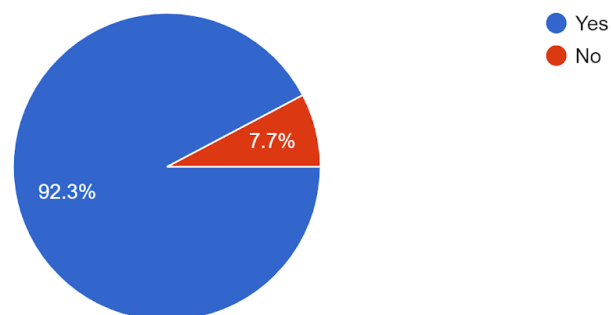
How much do you agree/disagree with the following statements?

I now have more effective strategies for solving complex puzzles

531 responses

- Strongly agree
- Agree
- Neutral
- Disagree

58.0%
25.0%
14.0%
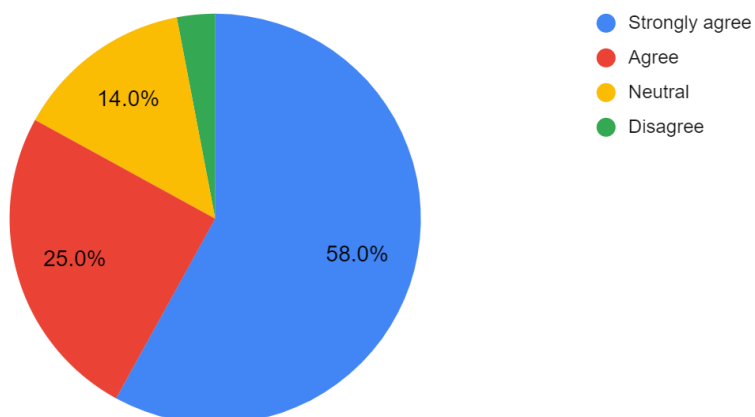
As a result of AILO, I am more confident in my problem solving skills

531 responses

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

55.0%
16.0%
21.0%
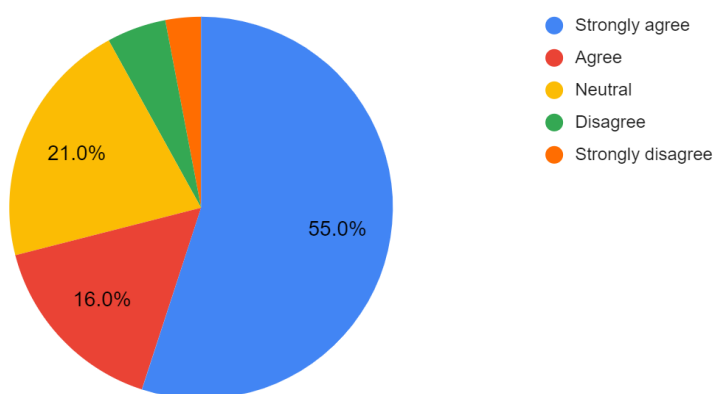
Solving a complex AILO puzzle is very satisfying

531 responses

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

46.5%
33.7%
14.9%
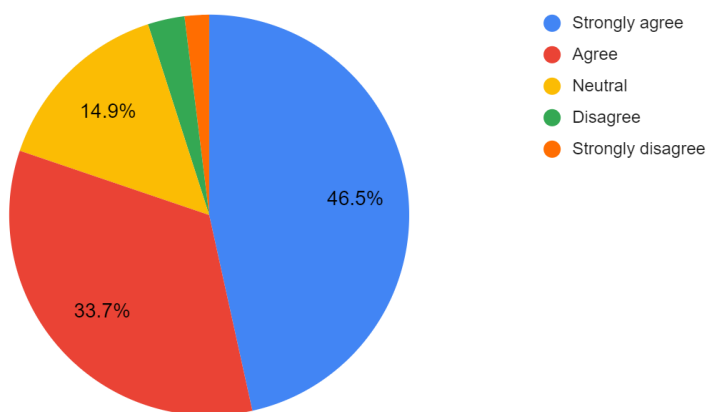
I learned strategies for solving puzzles in AILO
531 responses

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly disagree

20.3%
51.8%
19.2%
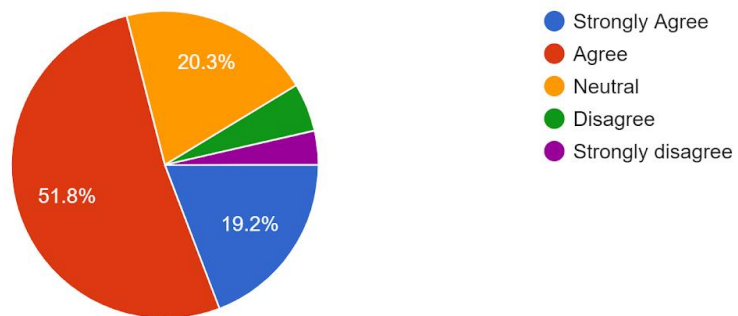
I learned new skills that I can use in other school subjects
531 responses

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

5.2%
26.6%
45.8%
20.4%
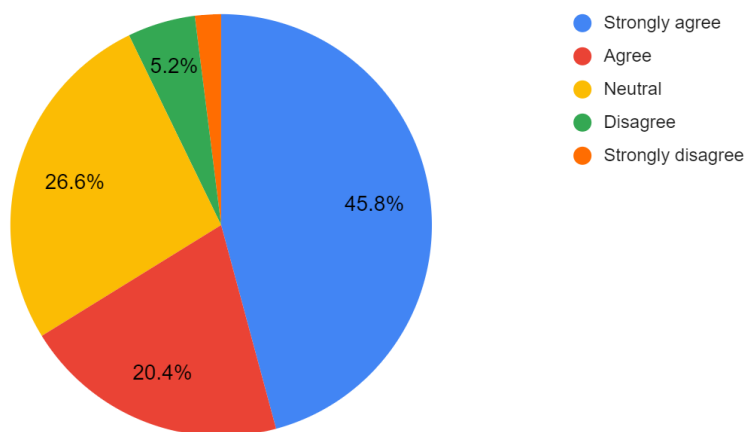
I learned new skills that I can use in other aspects of my life
531 responses

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

5.7%
25.2%
41.7%
25.4%
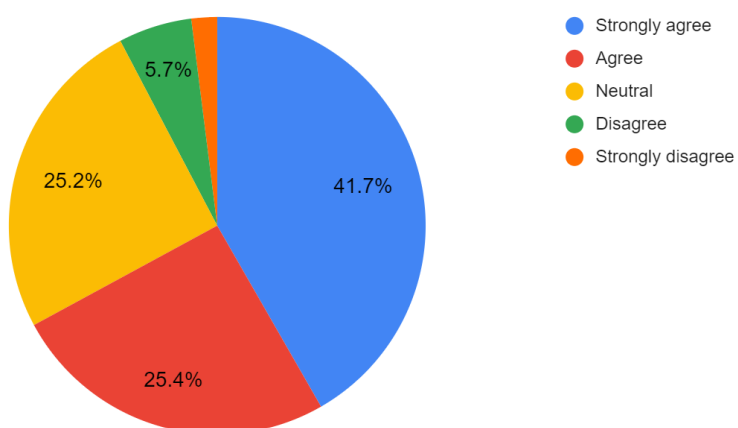
7. Moving online

The move to online went very smoothly, which was helped by the pilot round held with a number of schools in October 2019.

The move online was facilitated by two internships in Summer 2019. Bronagh Carolan and Chihun Lee joined ADAPT for eight weeks to develop 'AILO Online". Bronagh was a former AILO student herself, and went on to study Computer Science and Language / Linguistics at TCD during which time she joined ADAPT as an intern. These internships included a practise area for students, an October pilot round and initial technical set up for the January round.

Over three quarters of the 1100 students took the preliminary round online in their own schools in January 2020. A few issues around access to technology (e.g. access to the computer room or wifi issues) were raised by schools. In this case, as a pilot year, these schools were allowed to do the round on paper (and email in answer sheets).

8. Learnings from Workshop and Jan 2020 Preliminary Round Surveys

The 2020 Preliminary Round online survey was conducted online via a link at the end of the round. 531 of the 1100 students filled out the surveys. The results point to short-term impact goals such as increased confidence in tackling complex problems (71%, up from 70% post workshops) and students reporting that have effective strategies for solving problems (83%, up from 72% post workshops). Students report seeing clear links between their love for problem-solving and STEM career pathways (78%).

With regard to AILO's medium impact goals, 81% of students post-preliminary round considered doing linguistics/computing/language in College (compared to 56% pre-workshop). They also found solving a complex AILO problem very satisfying (81%). Students also reported that they learned new skills they can use in school subjects (66%) and other aspects of their lives (67%).

9. References

OECD (2014), PISA 2012 Results: Creative Problem Solving: Students' Skills in Tackling Real-Life Problems (Volume V), PISA, OECD Publishing. http://dx.doi.org/10.1787/9789264208070-en

OECD (2017), PISA 2015 Results: Collaborative Problem Solving (Volume V), PISA, OECD Publishing. http://www.oecd.org/publications/pisa-2015-results-volume-v-9789264285521-en.htm

WEF (2016) The Future of Jobs Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution. World Economic Forum http://reports.weforum.org/future-of-jobs-2016/chapter-1-the-future-of-jobs-and-skills/#view/fn-1

Appendix A – Nov 2019 –Jan 2020 Post Workshop Survey

Q1. Had you considered studying computing, languages, linguistics/ STEM at university before today?

Q2. Would you now consider studying computing, languages or linguistics at university?

Yes / No

Q3. Would you recommend AILO to a friend?

Yes / No

Q4. Would you like to take Round 1 of AILO in your school at the end of January?

Yes / No

Q5. What is your overall assessment of the workshop today?

Very Satisfied   Satisfied   Neutral   Unsatisfied   Very Unsatisfied

Q6. What topics or aspects of this workshop did you find most interesting / useful?

_____

Q7. How much do you agree / disagree with the following statements? (please circle)

I have effective strategies for solving complex problems

Strongly agree   Agree   Neutral   Disagree   Strongly Disagree

I am confident in my current problem solving skills

Strongly agree   Agree   Neutral   Disagree   Strongly Disagree

I learned strategies for solving puzzles in this workshop

Strongly agree   Agree   Neutral   Disagree   Strongly Disagree

I would recommend this workshop to a friend

Strongly agree   Agree   Neutral   Disagree   Strongly Disagree

Comments / Feedback:

_____
_____

Appendix B – AILO 2020 Online Preliminary Round Survey

ADAPT All Ireland Linguistics Olympiad 2020 Preliminary Round Survey

Please take a minute to complete the following questionnaire about your experience of AILO. It will help us immensely!

Question 1.

Did you try sample puzzles prior to taking the Preliminary Round in your school?

Question Type

Yes

No

or

If Yes how useful were they?

Very useful

Useful

Average

Not useful

Not at all useful

If Yes, how often did you use puzzles?

Daily

Weekly

Monthly

Once-off

Question 2.

Did you attend an AILO workshop in your school/elsewhere?

*

Yes

No

if yes, how useful was it?

Very useful

Useful

Average

Not useful

Not at all useful

Question 3.

Do you agree with the statement: I can see a link between problem solving and careers in Science, Technology, Engineering and Computing (STEM)?

*

Strongly Agree

Agree

Neutral

Disagree

Strongly Disagree

Question 4.

Before doing AILO, would you have considered studying computing, languages, linguistics or STEM at university?

*

Yes

No

Question 5.

Would you now consider studying computing, languages, linguistics/ STEM at university?

*

Yes

No

Question 6.

Would you recommend AILO as a competition for sharpening problem solving skills?

*

Yes

No

Question 7. How much do you agree/disagree with the following statements?

I now have more effective strategies for solving complex skills

*

Strongly Agree

Agree

Neutral

Disagree

Strongly Disagree

As a result of AILO, I am more confident in my current problem solving skills

*

Strongly Agree

Agree

Neutral

Disagree

Strongly Disagree

Solving a complex AILO problem is very satisfying

*

Strongly Agree

Agree

Neutral

Disagree

Strongly Disagree

I learned strategies for solving puzzles in AILO

*

Strongly Agree

Agree

Neutral

Disagree

Strongly disagree

I have learned new skills that I can use in other school subjects

*

Strongly agree

Agree

Neutral

Disagree

Strongly disagree

I have learned new skills that I can use in other aspects of my life

*

Strongly Agree

Agree

Neutral

Disagree

Strongly Disagree

Comments / Other Feedback

.

Appendix C: Overview of AILO Learning Outcomes linked to Junior Cert (JC) Curricula, JC Key Skills & Statements of Learning (SoL) and the PISA Problem Solving Competencies (2014/7)							
Students learn about	**JC Key Skills**	**JC Modern Foreign Languages**	**JC Coding**	**JC Maths**	**JC Statement of Learning**	**PISA**	**Students should be able to:**
Developing a positive disposition towards investigating, reasoning and problem-solving	□		□	□	SoL 15	□	1 Discuss the importance of problem-solving skills as a key component in a STEM career.
Seeing patterns and trends in language	□	□		□	SoL 2, 15, 16	□	2 Recognise patterns in language that make a language rule e.g. the 'code' of the language. 3 Complete logic & AILO puzzles
Tackling linguistics puzzles in unfamiliar languages	□	□		□	SoL 17	□	4 Understand when and how to use tables and charts to decipher data for each problem type (number systems, semantics, writing systems, phonetics, syntax, morphology.)
Problem solving strategies for each of the 6 types of AILO puzzle	□	□	□	□	SoL 17	□	5 Describe the observations they made about the language with concise and complete rules.
Gathering, interpreting and representing data	□	□	□	□	SoL 1,18	□	6 Monitor and reflect on language and how it affects their own language learning.
Expressing ideas clearly and accurately	□	□		□	SoL 1	□	7 Work as a team and reflect on their role in the team (Round 2, IOL)

Collaborative problem-solving techniques (Round 2, IOL)							
				□	SoL 17	□	

Appendix D: ADAPT AILO Problem Solving Olympiad and Key Junior Certificate Skills

In addition to their specific content and knowledge, the subjects and short courses of junior cycle provide students with opportunities to develop a range of key skills in order to achieve set Statements of Learning. This document describes the links between AILO and the Junior Cycle Key Skills (Table 1) and Statements of Learning (Table 2) with regard to Modern Foreign Languages, Maths and Coding. Figure 1 shows the Junior Cycle (JC) curriculum focuses on eight key skills (and their constituent elements):

Figure 1: Key skills of Junior Cycle

Table 1: Links between ADAPT AILO Problem Solving Olympiad and Junior Certificate (JC) key skills on Coding, Maths and Modern Foreign Languages

JC Key Skill	Key Skill Element	JC Coding?	JC Maths?	JC MFL?	ADAPT AILO Problem Solving Student Learning Activity
Being creative	Exploring options and alternatives		✓	✓	As students engage in a task for which the solution is not immediately obvious, they ask questions, explore ideas and alternatives, evaluate ideas and actions and take more responsibility for their learning.
	Learning creatively	✓			Students problem solve in a new way – using language.
Being literate	Expressing ideas clearly and accurately	✓	✓		Students use tools such as tables and charts to analyse data, and structures rules to present results. Students explain their thinking and justify their reasoning, using tables, charts and rules appropriately and accurately.
	Developing my understanding and enjoyment of words and language.			✓	Students become aware of new languages structures, patterns and influence on their own language learning.
Being numerate	Seeing patterns, trends and relationships	✓	✓	✓	Students develop strategies to analyse language data and note patterns and relationships. Participation in language activities will offer students many opportunities to reinforce concepts such as number recognition, sequencing, date, time, value, measurement, and percentage. They will also notice linguistic and cultural patterns and trends as they develop language and intercultural awareness.
			✓		

Category	Skill				Description
	Gathering, interpreting and representing data				Students generate rules that describe the grammar of the language data.
	Developing a positive disposition towards investigating, reasoning and problem-solving		✓		Students solve complex problems which demonstrate their use and understanding of mathematical and computational ideas.
Communicating	Using language			✓	Students become familiar with other language structures.
	Using numbers	✓	✓		Students use logic and numerical skill to solve problems; to support their reasoning and conclusions; and to convey and explain patterns and relationships.
	Discussing and debating				Students discuss ideas, evaluate the pros and cons of different approaches, and propose solutions.
Managing information and thinking	Thinking creatively and critically.	✓	✓		Students engage in tasks which require them to use their mathematical knowledge and skills in novel ways.
Managing myself	Setting and achieving personal goals	✓			Students take responsibility for personal learning by setting goals and seeking help when necessary from classmates, the teacher or the AILO online training page, and by reflecting on the feedback they receive.
					Students reflect on which learning activities they find most effective, using this knowledge to help further their learning.

		✓	✓	
	Being able to reflect on my own learning			
Staying well	Being social			Students get to know students in their local schools and around the country with similar interests.
	Being confident, being positive about learning	✓	✓	Students enjoy frequent opportunities to experience success in solving complex problems. They experience a positive approach to learning in which different approaches are valued and they are encouraged to learn from mistakes.
Working with others	Co-operating	✓		Students develop good working relationships with others working in AILO teams.
	Learning with others	✓	✓	They learn how to engage in collaborative work.

Table 2: Links between ADAPT AILO Problem Solving Olympiad and Junior Certificate Statements of Learning (SOL)

Junior Cert Statement of Learning (SOL)	JC Coding?	JC Maths?	JC MFL	Examples of Related Learning in the ADAPT AILO Problem Solving Olympiad
SOL 1: The student communicates effectively using a variety of means in a range of contexts in their first language.		✓		Students organise, consolidate and communicate logical thinking clearly and coherently to peers, teachers and others verbally, and in written form using tables and charts with relevant language symbols.
SOL 2: Listens, speaks, reads and writes in L2 and one other language at a level of proficiency that is appropriate to her or his ability			✓	Students are introduced to a multitude of new languages. Students gain knowledge of new language structures and writing systems which can apply in their learning of a foreign language.
SOL 6: The student appreciates and			✓	Students reflect on the values, beliefs and traditions of another culture. By doing this, they will gain deeper insights into their own culture and develop a positive attitude towards as well as respect and

respects how diverse values, beliefs and traditions have contributed to the communities and culture in which she/he lives.				curiosity for diversity. They will also develop an awareness and appreciation of the multilingual and multicultural society in which they live.
SOL 15: The student recognises the potential uses of mathematical knowledge, skills and understanding in all areas of learning		✓		Students apply their problem-solving knowledge and skills to a wide variety of problems across different subjects, including gathering, analysing, and presenting data, and using logic to model real-world situations.
SOL 16: The student describes, illustrates, interprets, predicts and explains patterns and relationships	✓	✓	✓	Students use tools such as tables and charts to analyse data. Students interpret patterns in the data and describe their thinking and justify their reasoning. They then write succinct rules to present these relationships. Students become aware of new languages structures, patterns and influence on their own language learning. Students will learn how the target language works; they will explore, describe and explain patterns such as word order, word endings, sentence construction, and the verb system. By comparing the target language with other languages they know, students will look at the relationships between languages and will gain deeper insights into how their own language works.
SOL 17: The student devises and evaluates strategies for investigating	✓	✓		Students develop strategies to analyse language data and note patterns and relationships. Students develop problem-solving strategies through engaging in these tasks for which the solution is not immediately obvious. They reflect on their own solution strategies to such tasks

and solving problems using mathematical knowledge, reasoning and skills		and compare them to those of others as part of team element of AILO.
SOL 18: The student observes and evaluates empirical events and processes and draws valid deductions and conclusions.	✓	Students generate and summarise data, select appropriate graphical or numerical methods to describe it, and draw conclusions from graphical and numerical summaries of the data. As part of their understanding language data, they come to appreciate the distinction between contingent deductions from particular cases, and deductions which can be proved to be universally true.
SOL 19: The student values the role and contribution of science and technology to society, and their personal, social and global importance.		Students develop an understanding of collaborative and creative problem-solving as a key skillset underpinning core disciplines of ADAPT research including computer science, artificial intelligence and language technology.