Research Brief

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What are the educational and career experiences of former Australian Olympians after their participation in the International Mathematical Olympiad?

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Research Brief

What is the problem?

The International Mathematics Olympiads (IMO) are annual maths competitions for the most exceptionally gifted high school students from around the world. Some of the aims of the competition are the identification of students with exceptional mathematical talent during their formative years, the promotion of the development of this talent through the provision of tasks that appropriately challenge the skills and knowledge of these students, the celebration of achievement in maths, and the encouragement of participants to make innovative contributions later on in math. The first IMO was hosted by Romania in 1959, with participants from only seven Eastern European countries. Today, it has become a truly international event, drawing the participation of 602 students from 106 countries in 2016.

Little is currently known about the post-Olympiad experiences and outcomes of Australian International Mathematical Olympians, particularly with respect to how they go about selecting their fields of tertiary study and careers, and how they go about developing their mathematical talent in the context of their tertiary studies and careers. The tremendous potential of these Olympians means that they may be among those with the greatest capacity to make ground-breaking advances that may benefit society and substantially alter the lives of its members. A clearer and a more complete understanding of the educational and career experiences of this elite group may allow valuable insights to be gained into the optimal approaches to provide them (and others with similar mathematical abilities/talent) with appropriate guidance and support.

What we did about it

Fifteen former Australian International Mathematical Olympians, who had completed their tertiary studies and were engaged in employment, were interviewed about their post-Olympiad experiences.

Socio-demographic Details of Participants

Participant	Age	Gender	Ethnicity	Undergraduate Studies	Graduate Studies	Current Position	Father Job	Mother Job
#1	46	M	Anglo-German	Maths/Australia	Maths (PhD), Finance (Diploma) and Education (Diploma)/ Australia	Technology/Australia	Electronics Technician	Housewife
#2	29	M	Anglo-Saxon	Maths/Australia	None	Technology/Australia	Engineer	Human resources
#3	24	M	Chinese	Maths/USA	None	Finance/U.S.A	Academia	Technician
#4	30	M	Chinese	Medicine and Medical Science/Australia	Anatomy (Diploma)/ Australia	Medical doctor/Australia	IT consultant	Loans administrator
#5	33	M	Chinese	Medicine/Australia	Undertaking Medicine PhD/ Australia	Medical doctor/Australia	Medical doctor/ Australia	Medical doctor
#6	38	M	Italian/ Anglo-Saxon	Maths, Law and Modern Languages/Australia	Maths (Masters)/Australia Maths (PhD)/ USA	Academia/Australia	Latin teacher	Medical scientist
#7	26	F	Chinese	None	Maths (Masters)/ U.K.	Technology/Australia	Engineer	Small business
#8	31	M	Hungarian/Swiss	Maths/Australia	None	Technology/U.S.A	Engineer	Entrepreneur
#9	25	M	Czech/Hungarian	None	Maths (Masters)/ U.K.	Finance/U.S.A.	Software architect	Project manager
#10	29	M	Anglo-Saxon	Maths/Australia	Maths (PhD)/ U.K.	Academia/Germany	Veterinarian	Teacher
#11	29	M	Anglo-Saxon	Maths, Physics and Commerce/Australia	Maths (Masters)/ Australia Maths (PhD)/ U.S.A.	Academia/U.S.A.	Academia/Engineer	Academia
#12	34	M	Anglo-Saxon	Maths/Australia	Maths (PhD)/U.S.A.	Academia/U.K.	Academia	Engineer
#13	38	M	Vietnamese	Maths and Engineering/ Australia	Maths (PhD)/Australia	Academia/Australia	Labourer	Accounts clerk
#14	32	M	Anglo-Saxon	Maths and Engineering/ Australia	Maths (DPhil)/ U.K.	Technology/ New Zealand	Veterinarian	Occupational therapist
#15	33	F	Chinese	Medicine/Australia	Epidemiology (Masters)/ Australia	Medical doctor/Australia	Academia	Engineer

What we found

Tertiary

Generally, the participating Olympians were likely to pursue studies in maths at the undergraduate level in a Group of Eight institution in Australia, by itself, or in combination with other fields. There were a number of exceptions to this rule, with three participants pursuing studies in medicine, and four pursuing studies in maths at foreign institutions. Those participants who pursued tertiary studies in maths noted that they were naturally drawn to maths, with some suggesting that due to their abilities, inherent interest, and enjoyment of maths, no conscious decision to pursue maths was even necessary.

The Olympians appeared to have varied experiences at university. While they generally noted that the undergraduate study experience provided some challenge and required a substantially greater time commitment than in high school, some experienced minimal challenge and others experienced excessive challenge. Nevertheless, most Olympians achieved at a very high level. Perhaps reflecting their exceptional capabilities, many followed a non-typical, self-designed study program, with some studying subjects in excess of the typical load, a couple accelerating their studies, and a few engaging in self-study outside of classes.

For PhD level studies, most Olympians recognised the benefits of studying overseas at one of a select number of elite institutions in the United States or the United Kingdom. In particular, there was acknowledgement that a more rigorous mathematical education was possible overseas, due to the possibility of interaction with greater numbers of exceptional mathematicians, and greater opportunities for exposure to and feedback on advanced mathematical ideas. There was also a view that an overseas education would prove advantageous later on in securing desired employment.

What we found

Careers

Generally, the Olympians appeared to conceptualize their career options as existing in a number of categories: (a) a career in "maths" (i.e., a maths academic and/or researcher), (b) careers in "industry" (i.e., finance or technology), and (c) non-maths careers. Among the first two categories, those who ceased their maths studies at the undergraduate or masters level pursued careers in industry, while those who pursued PhD studies in maths progressed into maths academia/research.

For many Olympians, the career decision was seen as a "natural" decision that represented a logical progression from their prior studies in maths. These participants tended to pursue studies in maths up to the highest level (i.e., PhD) and sought careers in academia/research later on. Among those who diverged from the maths academia/research "track" were those who were uncertain about their careers or perceived the career decision to represent a compromise from among the many considerations in a career. Regardless of the career decision that was made, however, many recognized that more career-related opportunities existed overseas than in Australia.

Multiple factors appeared to be considered in making the career decision. First was interest/enjoyment, although what each individual participant considered to be interesting and/or enjoyable varied. Among the more instrumental factors were income, career prospects, stability, and prestige. With respect to lifestyle, those who pursued a career in industry or non-maths fields made note of the work-life balance that may be superior in these fields, while those in academia/research noted the freedoms of an academic lifestyle. With respect to the possible impact on others, many noted the greater immediacy and visibility of the impact of one's work within non-academic fields.

Some factors that appeared to be particularly salient for Olympians who did not pursue careers in academia/research were questions about their capability in maths, the substantial effort and long timeframes that would be necessary to be successful in academia/research, and a perception of a lack of fit for academia/research.

Regardless of the specific career that was selected, there was a general consensus that the nature of mathematical development was different to the development that took place during one's education. For those in academia/research, there was a recognition of the: (a) larger scale and greater complexity of the maths problems that they now had to self-develop and solve, (b) increasing independence as a researcher, and (c) a greater consciousness and deliberation in the direction of one's mathematical development. In comparison, the majority of those who pursued careers outside of academia/research believed that there was no real development of their mathematical talent due to their work and non-work commitments. Irrespective of their lack of mathematical development however, many participants expressed satisfaction in the development of their abilities in other areas. Indeed, all of the Olympians who pursued maths-related or non-maths careers appeared to be satisfied or at least content in their careers.

Key Takeaways

- **The International Mathematical Olympiad Programs play a pivotal role in the decision to study maths at university**

  Experiences in the Olympiad Program appear to be particularly important in the educational/career trajectories of the Olympians at one of its pivotal initial stages — the decision about the discipline to study as an undergraduate student. For many Olympians, the experience appears to have been positive, as it offered intellectual challenge, along with early access to a community of outstanding mathematicians, mentors, and like-minded/like-ability peers.

- **The common selection of multiple areas of study at university reflects the multiple capabilities and interests of Olympians**

- **Gifted education interventions are also needed in university settings**

  Some Olympians continued to experience minimal challenge and stimulation in their tertiary studies. As a result, many proactively made adjustments to their undergraduate study program through interventions such as ability/achievement grouping, acceleration, overloading, self-paced personal study, and mentorship.

- **"Brain drain" of the most capable young mathematicians**

  Most Olympians who pursued PhD studies went on to this level of study at elite institutions in the United States or the United Kingdom. Thereafter, most pursued careers in these countries. Some of the main motivators for the brain drain appear to be the easier access overseas to high-quality mathematical education, exposure to a critical mass of expert mathematicians, other opportunities for the development of one's mathematical talent, and improved career prospects.

- **Future time perspective influences the career decision of Olympians**

  Those Olympians who did not pursue academic/research careers tended to have a short-term outlook, and valued outcomes that would be immediate, practical, and visible to other members of society, while those who pursued academic/research careers appeared to be satisfied with advancing knowledge in their field and any outcomes that may materialise in the more distant future.

- **Ethnicity may influence the career decision**

  All three Olympians who pursued careers in non-maths fields (i.e., medicine) in this study were of Asian ethnicity. In comparison, all of the European Australian participants pursued careers that were related to maths (i.e., academia/research, technology, and finance).

- **All participants achieved exceptional educational and career outcomes**

- **An optimal approach to support the mathematical development of Olympians**

  The study findings suggest that to optimally support the mathematical development of Olympians, there should be a promotion of: (a) undergraduate studies in maths, (b) PhD studies in maths at certain established institutions in the United States or the United Kingdom, and (c) the pursuit of academic/research roles in North America, Europe, or Australia. The profile of a former Olympian who may be most likely to undertake such a course of action may be one who has an inherent interest in maths research, self-confidence about one's abilities in maths, a long-term outlook, the support of expert mathematical mentors, and a willingness to make an independent career decision.

About the Researchers

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Jihyun Lee is a Professor of Educational Assessment at the School of Education, UNSW-Sydney. Her specialisation is in international and national large-scale assessment (e.g., PISA and NAPLAN), 21st Century Skills assessment, and survey design. She has thus far produced 85 publications and served on several prestigious international and national committees such as PISA 2022 Questionnaire Development for the OECD and the Standard Setting Advisory Group (SSAG) for the AITSL. She teaches research methods, survey design, educational assessment, and quantitative data analysis.

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Dr Jae Yup Jared Jung is an Associate Professor in the School of Education. His primary research focus is on the decision-making of adolescents (including gifted adolescents) on topics such as careers, university entrance and friendships, usually incorporating motivational and cultural perspectives.

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