



University of Malta Courses with Intermediate / Advanced Chemistry as a Requirement and/or Option: An Analysis of Students' Choices

Edward Thake

Martin Musumeci



L-Università
ta' Malta



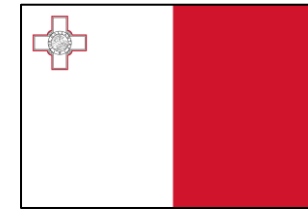
Contents

- Malta Landscape
- Theoretical Frameworks
- Research Methodology
- Results
- Analysis and Discussion
- Conclusion and Recommendations
- References



Malta

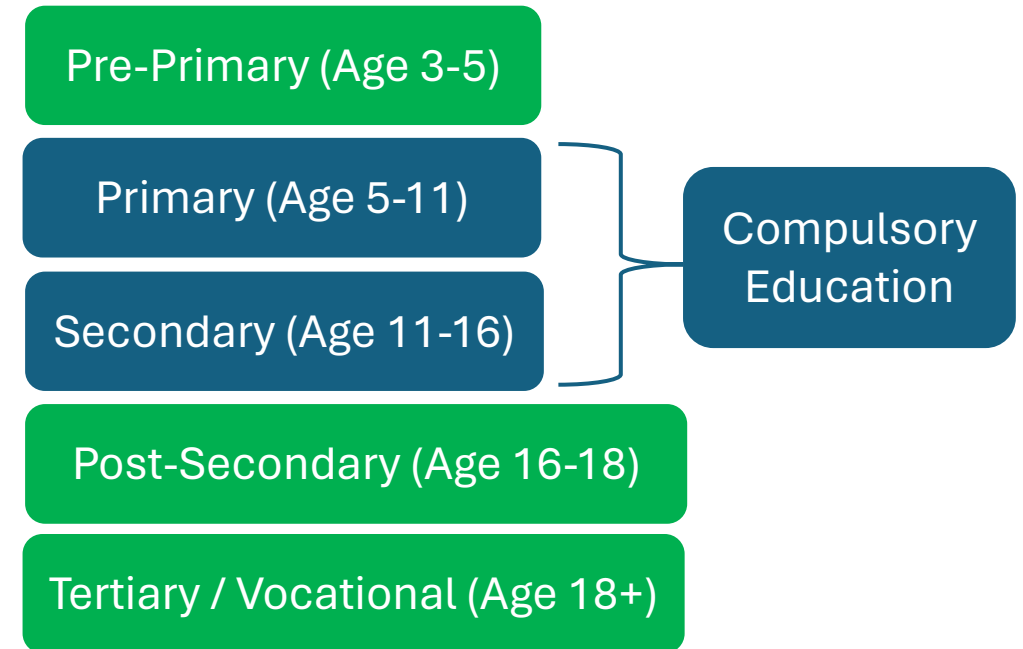
- Area: 316km² (122 sq. mi)
- Location: 80 km (50 mi) south of Sicily, Italy and 284 km (176 mi) east of Tunisia
- Population: 519,562 (census 2021)
- EU member since 2004





Malta's Education System

- Regulated by the Education Act of 1998
- Compulsory Education between ages of 5-16
- Post-secondary education in sixth forms and tertiary / vocational education by universities and technical colleges





University of Malta (UM)

- Public university in Malta
- Student population - 11,500 including 700 international students.
- 14 Faculties and 18 Institutes





UM Entry Requirements

- Post-Secondary Qualifications
 - 2 Advanced Matriculation (AM) subjects
 - 3 Intermediate Matriculation (IM) subjects
 - Systems of Knowledge (SOK)

**The above subjects need to include a language, science, and humanistic subject.*



L-Università ta' Malta



Aims of the Research Study

- To analyse course preferences of students with advanced matriculation (AM) and intermediate matriculation (IM) level chemistry in their 1st - 3rd year of university.
- To investigate influences behind students' enrolment choices, motivation in choosing UM course with chemistry as a requirement and / or option.
- To explore whether chemistry is perceived to give students wider career choices in the labour market.



Key Research Questions

RQ1

What motivates University students to choose tertiary courses specifying IM / AM level Chemistry?

RQ2

Does Chemistry at IM / AM level act as a restriction or an opening for student career options?



Theoretical Frameworks

Vocational Types Theory (VTT)	Sheds light on psychological aspects of career preferences, categorises chemists as investigative thinkers and realistic doers [8].
Social Cognitive Career Theory (SCCT)	Intricate interplay of personal, behavioural, and environmental factors in academic and career decisions [10-13].
Rational Choice Theory (RCT)	Suggests that students select a course based on personal preferences, beliefs, and limitations.



Research Methodology

- A mixed methods approach was adopted.
- Research instruments: analysis of statistical data and self-administered questionnaire.
- The questionnaires were distributed among 3 stakeholders:
 - UM students (1st – 3rd Year with IM/AM chemistry qualification)
 - Sixth Form Chemistry teachers
 - UM course coordinators (of courses of Interest)



Method

- The online questionnaire consisted of 17 questions, divided into 4 sections.
- Participants were contacted through the UM Registrar's office, social media and institutional websites.
- Convenience sampling was used.

Online Questionnaire Sections

Section I Demographics	Section II Course Choices
Section III Motivations for Choosing Chemistry	Section IV Career Choices



Mapping Student Participants 2020-22

- Population determined according to Undergraduate prospectus
- 26 courses specified Chemistry as an entry option and/or requirement.
- A total of 667 students were identified with IM / AM level Chemistry qualifications according to 2020-22 enrolment figures.



International Conference
**NEW PERSPECTIVES
in SCIENCE EDUCATION**



Results



Questionnaire Responses

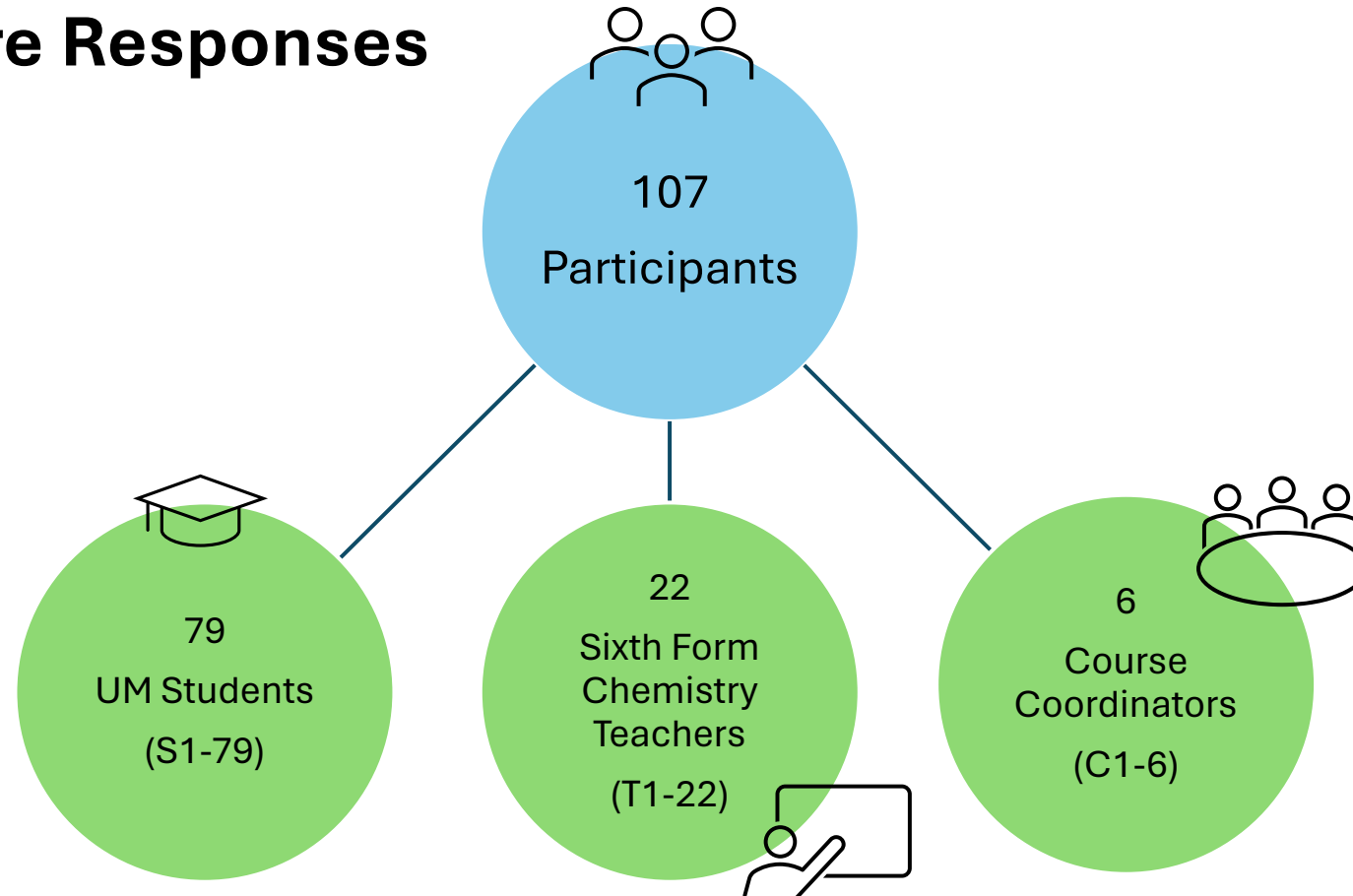




Table 1. Student Participants

Course	Year of Study			Total
	1 st Year	2 nd Year	3 rd Year	
B.Sc. (Hons) Information Technology (Computing and Business)			1	1
B.Sc. (Hons) Applied Biomedical Science	4	1	1	6
B.Sc. (Hons) Applied Food and Nutritional Sciences			1	1
B.Sc. (Hons) Biology	2	2	1	5
B.Sc. (Hons) Chemistry	1	4	3	8
B.Sc. (Hons) Medical Biochemistry		1	1	2
B.Sc. (Hons) Pharmaceutical Science	1	3	3	7
B.Sc. (Hons) Pharmaceutical Technology	2			2
B.Sc. (Hons) Pharmacology	1	1		2
B.Sc. (Hons) Podiatry	1		1	2
Doctor of Medicine and Surgery	9	15	13	37
Master of Dental Surgery	2	3	1	6
Total	24	30	25	79
Percentage	30.4%	38.0%	31.6%	100%



7 Themes which emerged from the questionnaire using thematic analysis





Results - UM Students

- Students' frequent motivations for choosing chemistry were “*family*” followed by “*teachers and mentors*”
- “*The attitude and teaching methods of my teacher at sixth form were pivotal to developing a positive attitude to a subject*” (S23).
- “*I always enjoyed the subject, but terrible teachers made the subject more challenging than it had to be*” (S44)



Results - UM Students

- 92.4% of participants (73 of 79) stated that IM and AM level Chemistry expanded their career choices.
- *“Most successful chose a completely different higher paying career path entirely” (S2).*
- 44.5% of students (35 respondents) expressed willingness to consider a Chemistry-related career abroad, emphasising the perceived global value of the subject.



Results – Sixth Form Chemistry Teachers

- Teachers believed that student choices are influenced by:
 - university requirements
 - future career aspirations
 - prestige
 - societal influences
 - job opportunities
 - family background (in accordance with Vocational Types Theory - VTT)
 - personal interests
 - peer influence



Results – Sixth Form Chemistry Teachers

- According to teachers, chemistry is perceived as difficult when compared to other subjects.
- There is lack of information about job trends “*I feel nobody tells us anything and we are very much out of the loop except from what we hear from ex-students*” (T2).
- Teachers highlight the lack of information about job trends and need for enhanced promotion of careers in Chemistry.
- Teachers expressed concerns about restricted career opportunities and advocated for promotion of chemistry careers.



Results – Course Coordinators

- Influences on student choices according to coordinators were personal goals, job availability, salaries, personal preferences (in accordance with Rational Choice Theory – RCT), and academic performance.
- Coordinators emphasised factors influencing student course choices aligned with the SCCT Model, addressing misconceptions about Chemistry, and highlighting its impact on interdisciplinary connections.
- *“Students with a chemistry background acquire analytical skills, data management abilities, research proficiency, logical thinking and problem-solving skills” (C4).*



Results – Course Coordinators

- Chemistry is viewed as contributing to interdisciplinary connections in curricula.
- Importance of aligning Chemistry as an entry requirement with industry standards and proposed syllabi changes to include diverse real-world applications. *“We are close to industry, and I regularly discuss the curriculum with industry exponents” (C6)*



Summary of Results

	Themes	University Students	Sixth Form Chemistry teachers	University of Malta Course Coordinators
1	Influence	<ul style="list-style-type: none"> - Family members - Teachers and mentors - Educational institutions - Career aspirations - Interest in the subject 	<ul style="list-style-type: none"> - University requirements - Future career aspirations - Prestige and societal influence - Job opportunities and satisfaction - Family background and personal interests - Peer influence 	<ul style="list-style-type: none"> - Personal goals - Job availability - Potential earnings - Personal preferences - Academic performance
2	Misconceptions	<ul style="list-style-type: none"> - Perceived to be difficult - Limited understanding of its applications - Limited career opportunities - Perception as a textbook science 	<ul style="list-style-type: none"> - Perceived to be difficult - Memorisation-based learning approach - Chemistry as a difficult subject compared to biology - Limited career opportunities 	<ul style="list-style-type: none"> - Perceived to be difficult - Limited understanding of its applications - Limited career opportunities - Perception as a textbook science
3	Motivation	<ul style="list-style-type: none"> - Career aspirations - Interest in the subject - Future qualifications 	<ul style="list-style-type: none"> - Career aspirations - Interest in the subject - Prerequisites for other programmes 	<ul style="list-style-type: none"> - Career aspirations - Interest in the subject - Future qualifications
4	Perceptions	<ul style="list-style-type: none"> - Positive perception - Concerns about domestic vs. international opportunities 	<ul style="list-style-type: none"> - Limited job market trends and opportunities in Malta - limiting career prospects (emphasis on medicine) 	<ul style="list-style-type: none"> - Need for diverse career prospects in Chemistry - Limited advertising
5	Career Aspirations	<ul style="list-style-type: none"> - Broad options in career choices - Positive impact on future career prospects 	<ul style="list-style-type: none"> - Varied opinions - awareness of the relevance of chemistry in real-world applications 	<ul style="list-style-type: none"> - Importance of lecturers and teachers in emphasising the subject's relevance
6	Acquired skills	<ul style="list-style-type: none"> - Career aspirations in Chemistry-related fields 	<ul style="list-style-type: none"> - Academic skills in chemistry - Analytical skills - Problem-solving skills 	<ul style="list-style-type: none"> - Analytical skills - Critical thinking abilities - Practical laboratory skills
7	Promoting Chemistry	<ul style="list-style-type: none"> - Hands-on activities - Visual aids and analogies - Laboratory sessions - Discussions 	<ul style="list-style-type: none"> - Hands-on activities and visual aids - Applying Chemistry to everyday life - Using humour - Incorporating questioning techniques and laboratory sessions - Importance of modernising the curriculum 	<ul style="list-style-type: none"> - Promoting interdisciplinary knowledge - Complementary to other science subjects - Ensuring a solid foundation for further education



Analysis and Discussion



Convergent Perspectives

- Career aspirations identified as a crucial factor in course choices, echoed by UM students and Sixth Form Chemistry teachers.
- Emphasis on aligning educational options and offers with students' career paths emphasised the pivotal role of addressing aspects in course design.
- Both teachers and course coordinators emphasise the integration of real-world applications of Chemistry, focusing on practical examples, context-based approaches, and job opportunities.



Divergent Perspectives

- Students cited family influence as their main reason for choosing chemistry. Teachers indicated a number of factors such as university requirements, prestige and personal interest.
- UM students identified a lack of promotion of the subject. Sixth form chemistry teachers expressed mixed opinions.



Limitations

1. A large sample size could have provided a more comprehensive explanation of students' views and experiences with IM / AM chemistry qualifications.
2. A more representative sample of course coordinators would have been representative.



Conclusions

- There are a number of intricate factors that influence students' decisions of course selection.
- A different approach can be adopted to support students' course choices.
- Students perceive Chemistry as a valuable qualification for career opportunities.
- Chemistry education can be enhanced by dispelling misconceptions, aligning courses with career aspirations, and integrating real-world applications.



Recommendations

- Include real-world applications into the curriculum using practical examples.
- Make Chemistry more relevant to students' daily lives, enhancing their engagement and success in related courses.
- Incorporate research insights into future curriculum design, teaching methods, and support systems to proactively boost student engagement, interest, and achievement in tertiary Chemistry courses.



Future Research

- Seek feedback from employers and chemistry professionals to align academic programmes with industry requirements.
- Propose a cross-cultural comparison on Chemistry choices to tailor educational approaches to diverse student populations and foster inclusivity.



References

- [1] Regan, E., & DeWitt, J. (2014). Attitudes, interest and factors influencing STEM enrolment behaviour: An overview of relevant literature. In Understanding student participation and choice in science and technology education, pp. 63-88.
- [2] Thake, E. (2023). Courses Requiring Intermediate / Advanced Level Chemistry at the University of Malta: An Analysis of Students' Choices (unpublished Master dissertation).
- [3] Magro, M., & Musumeci, M. (2019). Trends and patterns in subject choice by science students at sixth form level in Malta. In Conference Proceedings: New Perspectives in Science Education 8th Edition.
- [4] Musumeci, M. (2015). Subject Choice and Performance in Chemistry and the Science Subjects in Malta: Patterns According to Gender and School Type. In Conference Proceedings International Conference New Perspectives in Science Education 4th Edition.
- [5] Southerland, S. A., Johnston, A., & Sowell, S. (2006). Describing teachers' conceptual ecologies for the nature of science. *Science Education*, 90(5), 874-906.
- [6] Chen, X. (2013). STEM Attrition: College Students' Paths Into and Out of STEM Fields (NCES 2014-001). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.
- [7] Herfeld, C. (2018). From theories of human behavior to rules of rational choice: tracing a normative turn at the Cowles Commission, 1943–54. *History of Political Economy*, 50(1), 1-48.
- [8] Wittek, R., Snijders, T. A., & Nee, V. (Eds.). (2013). *The handbook of rational choice social research*. Stanford University Press.
- [9] Holland, J.L., Daiger, D.C., Power, P.G. (1980) *My Vocational Situation*. Palo Alto, CA, Consulting Psychologists Press.



- [10] Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of vocational behavior*,45(1), 79-122.
- [11] Adebusuyi, A. S., Adebusuyi, O. F., & Kolade, O. (2022). Development and validation of sources of entrepreneurial self-efficacy and outcome expectations: A social cognitive career theory perspective. *The International Journal of Management Education*, 20(2), 100572.
- [12] Garriott, P. O., Hudyma, A., Keene, C., & Santiago, D. (2015). Social cognitive predictors of first-and non-first-generation college students' academic and life satisfaction. *Journal of Counselling Psychology*, 62(2), 253.
- [13] Gibbons, M. M., & Borders, L. D. (2010). Prospective first-generation college students: A social-cognitive perspective. *The Career Development Quarterly*, 58(3), 194-208.
- [14] Malta Union of Teachers – A Short Overview of the Education System in Malta. Retrieved January 20, 2024, from <https://mut.org.mt/information/education-system-overview/>
- [15] University of Malta – Admissions and advice – Admissions FAQs – Entry Requirements. Which subjects do I need in order to satisfy the University's General Requirements? Retrieved January 20, 2024, from <https://www.um.edu.mt/study/admissionsadvice/admissionsfaqs/>
- [16] University of Malta, Undergraduate Prospectus 2022 & 2023. Retrieved January 20, 2024, from https://www.um.edu.mt/media/um/docs/study/admissions/UG_Prospectus.pdf
- [17] Creswell, J. W., & Clark, V. L. P. (2018). *Designing and conducting mixed methods research*. Sage Publications.
- [18] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.



Thank You

edward.thake@ilearn.edu.mt

martin.m.musumeci@um.edu.mt



Questions?