

# Choice in the Science Subjects: Trends in Malta

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## Abstract

*Within the Maltese educational system, students have subject choice at age 12-13, prior to the beginning of their third year of secondary schooling. Pupils sit for an external 16+ Secondary Education Certificate (SEC) examination at the end of secondary school; those who satisfy the requirements can proceed to a two-year post-secondary Matriculation course. At sixth form, students choose two subjects at advanced level, three subjects at intermediate level and have the compulsory 'systems of knowledge'; the six subjects constitute the matriculation certificate (MC), an external 18+ exam, which is a passport to university. Considering the data for the past 14 years, 2004 to 2017, the study presents the trends and fluctuations in subject choice with respect to the three science subjects at both SEC and MC (intermediate and advanced) levels. Subject registration at the two levels are compared and contrasted. These trends are also compared with those of a number of compulsory SEC subjects (English language and mathematics) and other groups of subjects (foreign languages, commercial subjects, other optional subjects). Data is analysed per gender, and possible fluctuations and displacements from one 'area' to another are highlighted.*

**Keywords:** *subject choice, science subjects*

## 1. Introduction

Students have subject choices at the end of their second year of secondary schooling in Malta. Pupils then sit for an external 16+ Secondary Education Certificate (SEC) examination. Those who satisfy the requirements (six SEC passes, with English language, mathematics, Maltese and one science subject compulsory) can proceed to a two-year matriculation course, including two subjects at advanced (AM) level, three subjects at intermediate (IM) level and the compulsory 'systems of knowledge' (SoK). This constitutes the matriculation certificate (MC), an external 18+ examination, which includes at least one science subject (from six, including biology, chemistry and physics); this is a passport to university. Considering the data for the main May examination session for the past 14 years the study presents the trends in subject choice considering the science subjects at both SEC and MC levels. These are compared with those of two compulsory SEC subjects with the highest numbers of registrations (mathematics and English language) and with other clusters of optional subjects (foreign languages, commercial subjects, and 'other' optional subjects).

## 2. Research says ...

Research suggests: (i) great variations in subject choice and educational decisions; (ii) a mix of psychological and social factors often shapes students' choices and decisions; and (iii) personal and family backgrounds are important influences. Of particular importance in subject choice and further science uptake are: (i) experiences with school science; and (ii) knowledge of the range of study and career options involving science.

High ability students are most likely to opt for sciences. Parents', friends' and cultural groups' influence are significant factors on science uptake. There are other factors, as: perceptions of science at home; motivation, teacher advice, etc. Studies show that students' success levels in earlier school-years influence educational intentions and subsequent participation. Most science students are from the top two quartiles of achievement. Boys and girls tend to make different choices, with boys more likely to take separate sciences, and girls preferring modern foreign languages.

## 3. The situation at SEC level

There were 33 subjects at SEC level in 2004, increasing to 39 by 2017. Four subjects are compulsory for sixth form entry: English language, Maltese, mathematics, and one science subject (biology, chemistry or physics). Table 1 portrays SEC registrations from 2004 to 2017 for the three sciences, separately and as a total, English language and mathematics (having the highest registration), the total

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SEC registrations in raw numbers, and subject registrations as a percentage of total registrations for the three sciences. The decrease in total registrations over the years reflects the drop in birth rate.

	2004			2005			2006			2007		
	M	F	all	M	F	all	M	F	all	M	F	all
Biology (B)	422	998	1420	514	1091	1605	489	1076	1565	558	1242	1800
Chemistry (C)	365	455	820	431	433	864	431	432	863	450	547	997
Physics (P)	2119	2283	4402	2091	2247	4338	2193	2154	4347	2197	2311	4508
<b>B + C + P</b>	<b>2906</b>	<b>3736</b>	<b>6642</b>	<b>3036</b>	<b>3771</b>	<b>6807</b>	<b>3113</b>	<b>3662</b>	<b>6775</b>	<b>3205</b>	<b>4100</b>	<b>7305</b>
English Lan. (EL)	2746	3195	5941	2893	3336	6229	2863	3139	6002	2796	3210	6006
Mathematics (M)	2474	2897	5371	2582	3045	5627	2609	2950	5559	2640	3075	5715
<b>Total SEC reg.</b>	<b>3560</b>	<b>4301</b>	<b>7861</b>	<b>3664</b>	<b>4374</b>	<b>8038</b>	<b>3727</b>	<b>4256</b>	<b>7983</b>	<b>3617</b>	<b>4325</b>	<b>7942</b>
B wrt tot. reg. (%) (B%)	11.9	23.2	18.1	14.0	24.9	20.0	13.1	25.3	19.6	15.4	28.7	22.7
C wrt tot. reg. (%) (C%)	10.3	10.6	10.4	11.8	9.9	10.7	11.6	10.2	10.8	12.4	12.6	12.6
P wrt tot. reg. (%) (P%)	59.5	53.1	56.0	57.1	51.4	54.0	58.8	50.6	54.5	60.7	53.4	56.8

	2008			2009			2010			2011			2012		
	M	F	all	M	F	all	M	F	all	M	F	all	M	F	all
B	580	1205	1785	522	1155	1677	473	1178	1651	473	1064	1522	471	998	1469
C	482	527	1009	458	457	915	398	510	908	398	475	836	366	459	825
P	2200	2091	4291	2145	2020	4165	2213	2052	4265	2213	1964	4044	2025	1886	3911
<b>B+C+P</b>	<b>3262</b>	<b>3823</b>	<b>7085</b>	<b>3125</b>	<b>3632</b>	<b>6757</b>	<b>3084</b>	<b>3740</b>	<b>6824</b>	<b>3084</b>	<b>3503</b>	<b>6402</b>	<b>2862</b>	<b>3343</b>	<b>6205</b>
E. L.	2801	3132	5933	2692	2982	5674	2791	2901	5692	2791	2803	5371	2590	2736	5326
M.	2714	3058	5772	2584	2841	5425	2616	2882	5498	2616	2674	5164	2544	2815	5359
<b>Tot. reg.</b>	<b>3633</b>	<b>4246</b>	<b>7879</b>	<b>3424</b>	<b>3954</b>	<b>7378</b>	<b>3535</b>	<b>3957</b>	<b>7492</b>	<b>3535</b>	<b>3835</b>	<b>7177</b>	<b>3390</b>	<b>3905</b>	<b>7295</b>
B%	16.0	28.4	22.7	15.2	29.2	22.7	13.4	29.8	22.0	13.4	27.7	21.2	13.9	25.6	20.1
C%	13.3	12.4	12.8	13.4	11.6	12.4	11.3	12.9	12.1	11.3	12.4	11.6	10.8	11.8	11.3
P%	60.6	49.2	54.5	62.6	51.1	56.5	62.6	51.9	56.9	62.6	51.2	56.3	59.7	48.3	53.6

	2013			2014			2015			2016			2017		
	M	F	all	M	F	all	M	F	all	M	F	all	M	F	all
B	488	1048	1536	488	1025	1497	455	944	1399	482	986	1468	437	862	1299
C	372	451	823	372	427	779	349	386	735	349	474	823	329	400	729
P	2018	1749	3767	2018	1782	3748	1825	1630	3455	1727	1697	3424	1631	1476	3107
<b>B+C+P</b>	<b>2878</b>	<b>3248</b>	<b>6126</b>	<b>2878</b>	<b>3234</b>	<b>6024</b>	<b>2629</b>	<b>2960</b>	<b>5589</b>	<b>2558</b>	<b>3157</b>	<b>5715</b>	<b>2397</b>	<b>2738</b>	<b>5135</b>
E. L.	2527	2594	5121	2527	2686	5146	2261	2472	4733	2157	2454	4611	2089	2277	4366
M.	2479	2559	5038	2479	2646	5049	2107	2268	4375	2134	2463	4597	2055	2328	4383
<b>Tot. reg.</b>	<b>3181</b>	<b>3513</b>	<b>6694</b>	<b>3181</b>	<b>3543</b>	<b>6599</b>	<b>2727</b>	<b>3151</b>	<b>5878</b>	<b>2619</b>	<b>3211</b>	<b>5830</b>	<b>2521</b>	<b>2976</b>	<b>5497</b>
B%	15.3	29.8	22.9	15.3	28.9	22.7	16.7	30.0	23.8	18.4	30.7	25.2	17.3	29.0	26.7
C%	11.7	12.8	12.3	11.7	12.1	11.8	12.8	12.3	12.5	13.3	14.8	14.1	13.1	13.4	13.3
P%	63.4	49.8	56.3	63.4	50.3	56.8	66.9	51.7	58.8	65.9	52.8	58.7	64.7	49.6	56.5

Table 1. Data for SEC registrations for the science subjects, English and mathematics per gender per year

Figure 1 portrays the registrations for the sciences, English language and mathematics and the total number of yearly SEC registrations.

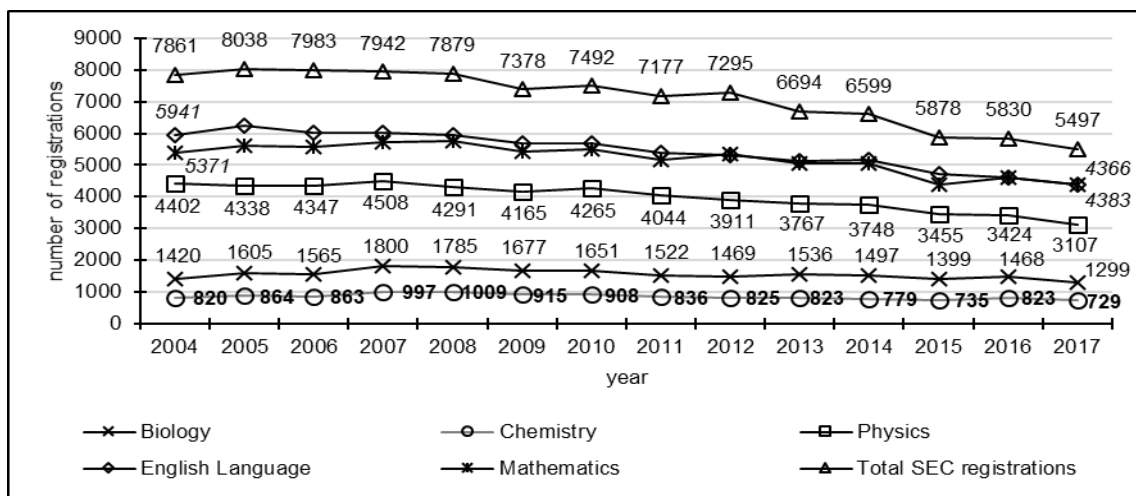


Fig.1. Number of subject registrations for B, C, P, EL and M and the total SEC registrations per year

Chemistry is the least chosen, with biology at circa twice and physics at roughly four to five times as much registrations. Physics was compulsory since 1981; the provision has changed to any science subject, but many schools still offer it as 'compulsory'. In percentage terms, they are circa 12%, 25% and 55% of total registrations for chemistry, biology and physics respectively. Figure 2 shows the registrations per gender per year. Gender differences in chemistry and physics are not pronounced, but there is bias towards female participation in biology.

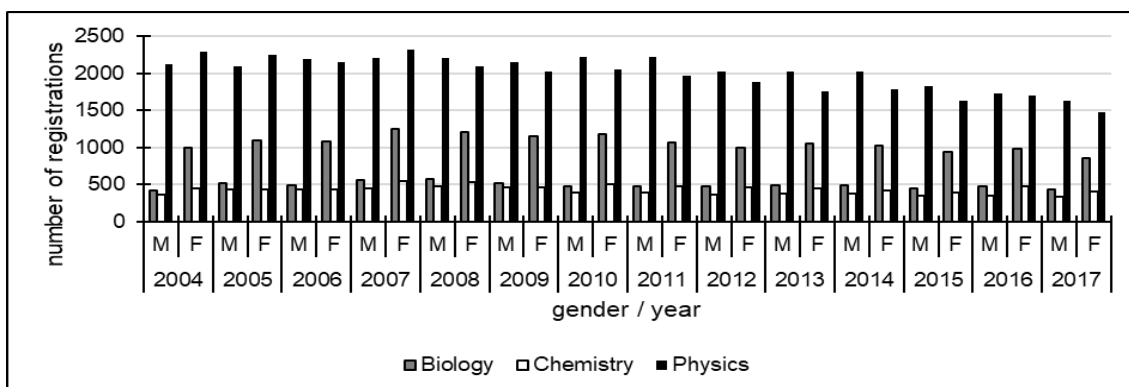


Fig.2. Registrations for biology, chemistry and physics per gender per year

The other SEC subjects can be clustered as: foreign languages (eight); commercial subjects (four); and other options (ten: art, computing, design and technology, European studies, geography, history, home economics, physical education, graphical communication, textiles and design; music as from 2014; five vocational subjects from 2017). Another eight subjects are offered at SEC level, including the compulsory sixth form subjects. Considering the four clusters one notes that (Figure 3) the total number of registrations for the sciences was always the highest.

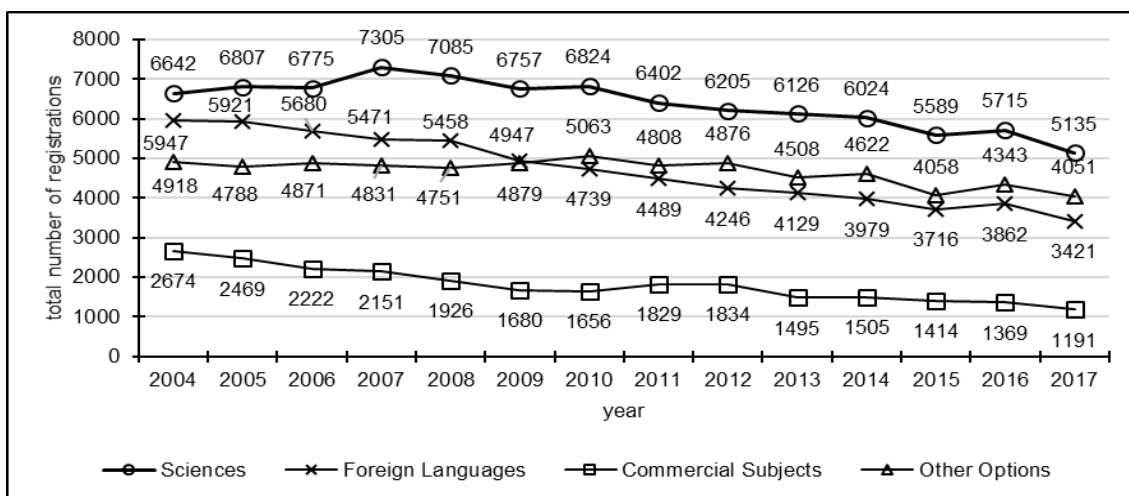


Fig.3. Total registrations for sciences, foreign languages, commercial subjects and other options per year

#### 4. The situation at Intermediate and Advanced Matriculation level

Table 2 shows the data for AM and IM biology, chemistry and physics, and SoK (compulsory in the MC) per gender per year. SoK is taken as a benchmark, as it indicatively shows the number of candidates sitting for the MC, being the main passport University of Malta enrolment.

	2004			2005			2006			2007		
	M	F	Tot	M	F	Tot	M	F	Tot	M	F	Tot
AM Biology	120	234	354	160	340	500	156	362	518	191	377	568
IM Biology	33	134	167	32	183	215	40	175	215	39	171	210
AM Chemistry	111	180	291	145	218	363	131	229	360	175	248	423
IM Chemistry	2	14	16	8	11	19	18	16	34	6	26	32
AM Physics	276	118	394	329	146	475	320	168	488	349	154	503
IM Physics	182	246	428	206	316	522	223	372	595	270	379	649
SoK	976	1257	2233	1028	1427	2455	1052	1498	2550	1071	1461	2532

	2008			2009			2010			2011			2012		
	M	F	Tot	M	F	Tot	M	F	Tot	M	F	Tot	M	F	Tot
AM B	173	325	498	193	401	594	209	372	581	189	343	532	211	431	642
IM B	40	168	208	43	171	214	38	187	225	48	215	263	42	188	230
AM C	152	201	353	156	252	408	175	254	429	174	200	374	184	260	444
IM C	16	22	38	12	40	52	20	35	55	17	29	46	19	32	51
AM P	337	156	493	303	175	478	267	150	417	297	147	444	336	163	499
IM P	265	358	623	295	417	712	339	384	723	359	399	758	320	393	713
SoK	995	1361	2356	989	1450	2439	1022	1392	2414	1019	1383	2402	1006	1348	2354

	2013			2014			2015			2016			2017		
	M	F	Tot	M	F	Tot	M	F	Tot	M	F	Tot	M	F	Tot
AM B	197	433	630	219	443	662	241	431	672	250	435	685	242	393	635
IM B	44	191	235	50	212	262	60	241	301	54	251	305	75	275	350
AM C	163	285	448	189	312	501	211	305	516	218	296	514	198	256	454
IM C	14	32	46	18	21	39	5	19	24	14	25	39	21	24	45
AM P	299	142	441	292	134	426	300	135	435	270	120	390	266	107	373
IM P	320	390	710	301	384	685	319	339	658	285	268	553	250	267	517
SoK	958	1321	2279	932	1275	2207	930	1122	2052	899	1232	2131	916	1155	2071

Table 2. Registrations for biology, chemistry, physics and SoK per gender per year

Figure 4 shows the yearly registrations. As of 2005, biology became the most popular AM science subject; AM biology registrations show a general increase. AM chemistry registrations show a general increase, but it was the least popular till 2009. In 2010, chemistry registrations surpassed physics (429 against 417, respectively). AM chemistry dipped again below physics in 2011 and 2012, but clearly surpassed physics from 2013 onwards. Physics registrations show a general decrease from 2012.

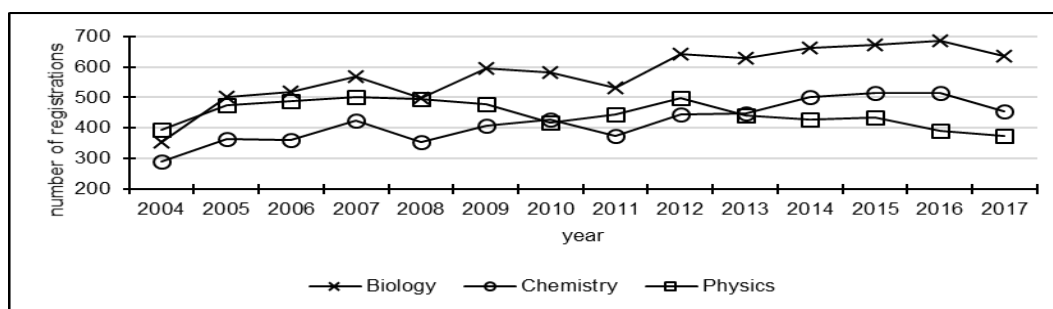


Fig.4. Number of AM registrations for the three science subjects per year

Considering AM registration as a percentage of the SEC registrations per subject, AM chemistry uptake showed a general increase to circa two thirds (and higher) of the SEC cohort. Biology increased to circa half the SEC cohort and, contrastingly, the percentage uptake for AM physics is fairly constant, at around 12%.

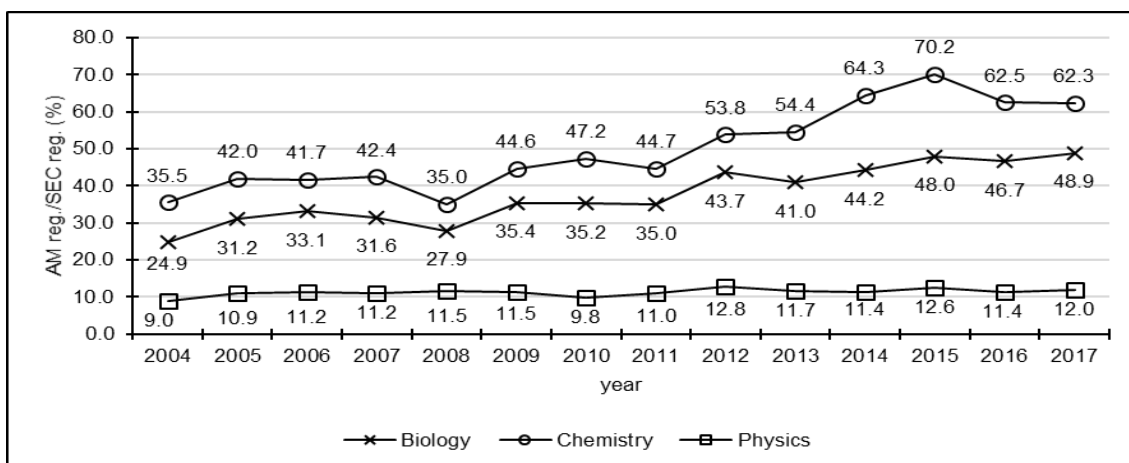


Fig.4. Number of AM registrations as a percentage of SEC registrations per subject per year

Data for IM level is completely different, mainly due to university special course requirements. The highest levels reached are: 6.2% for chemistry, 2011 and 2017; 26.9% for biology, 2017; at 18.8% in physics 2013.

### 5. Conclusion

Generally, more females sit for SEC science examinations. No significant displacement from science to other subjects is noted. There is internal displacement, from foreign languages to other options, where boys tend to go for 'softer' subjects. There are significant gender differences in biology at all levels and in physics at AM level.

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