

2021\_TR\_03 Lero Technical Report

# **Gender Balance in STEM: An Analysis of Ireland's Higher Education Authority Data**

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## 1. Problem statement

When writing Athena SWAN award submissions for Irish institutions and departments, Higher Education Authority statistics are often used to show comparison data nationally. The many statistics available in dashboard format on <https://hea.ie/statistics/> provide vital information for use. Currently, however, there is no means available which can convert these tables and charts easily to the format needed for their inclusion in the submitted AS documents.

This project, supported by the Department of Mathematics & Statistics, the Department of Computer Science and Information Systems and the Faculty of Science and Engineering at the University of Limerick, has demonstrated that the data provided by the HEA can be extracted, analysed in the manner required by the HEI, and can be inserted easily in the AS submission.

This project has also demonstrated that R<sup>1</sup> can be used to create graphs and tables in a format which is usable in Athena SWAN award submissions. This report illustrates this for two sets of data:

- Enrollments into all undergraduate programs offered in each Higher Education Institute.
- Enrollments into Honours Degrees in Universities only.

The data were analysed for the academic years 2018/2019 and 2019/2020.

## 2. Overview

This report explores the gender balance in Irish third level institutes using data available from the Higher Education Authority (HEA) statistics unit<sup>2</sup>. Enrollment and graduation numbers from the broad fields of study of *Information and Communication Technologies (ICT)*, *Natural Sciences*, *Mathematics and Statistics*, and *Engineering, Manufacturing and Construction*. These broad fields are defined by the HEA.

Analysis is presented for all undergraduate courses under the broad fields of study. A more detailed analysis follows illustrating the comparisons between Honours Degree enrollments within Universities.

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<sup>1</sup> <https://www.r-project.org/>

<sup>2</sup> <https://hea.ie/statistics/>

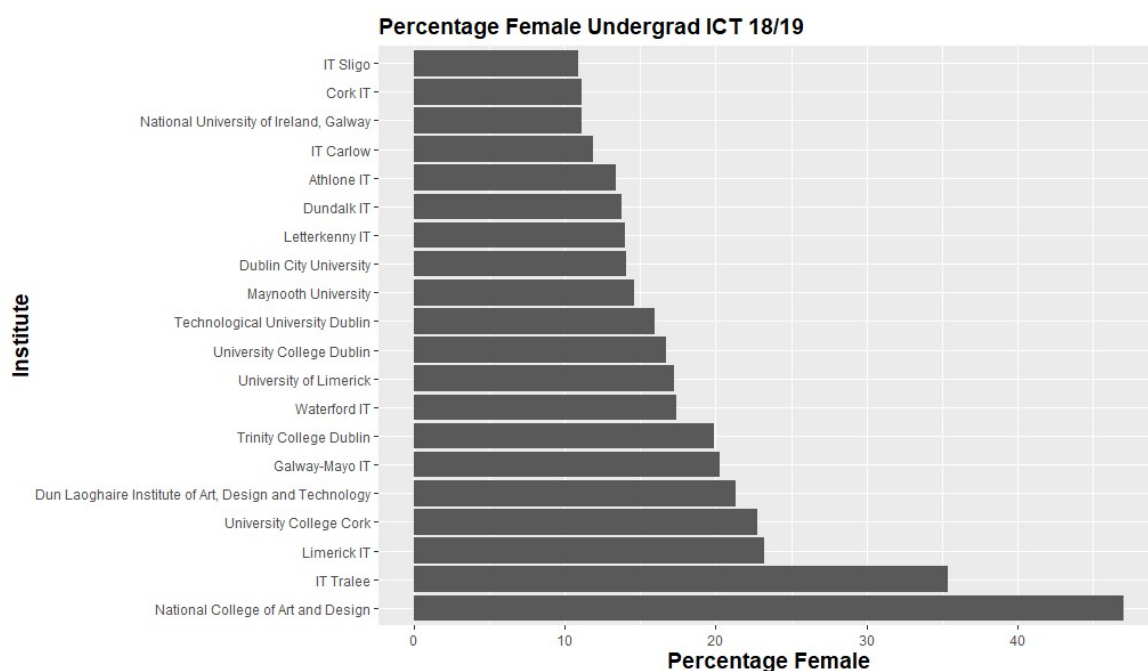
### 3. Analysis of enrollments into all undergraduate programs offered in each third level institute under Broad fields of study

#### 3.1 Information and Communications Technology (ICT)

**Table 1: Percentage of Female Students Enrolled in Undergraduate ICT Courses 2018/2019**

Institute	Female	Male	Total	Percent Female
IT Sligo	36	295	331	10.9
Cork IT	75	602	677	11.1
National University of Ireland, Galway	29	232	261	11.1
IT Carlow	45	335	380	11.8
Athlone IT	41	265	306	13.4
Dundalk IT	67	420	487	13.8
Letterkenny IT	50	307	357	14.0
Dublin City University	111	678	789	14.1
Maynooth University	59	346	405	14.6
Technological University Dublin	375	1977	2352	15.9
University College Dublin	82	408	490	16.7
University of Limerick	114	547	661	17.2
Waterford IT	88	419	507	17.4
Trinity College Dublin	92	371	463	19.9
Galway-Mayo IT	128	503	631	20.3
Dun Laoghaire Institute of Art, Design and Technology	46	170	216	21.3
University College Cork	201	681	882	22.8
Limerick IT	155	512	667	23.2
IT Tralee	79	144	223	35.4
National College of Art and Design	8	9	17	47.1

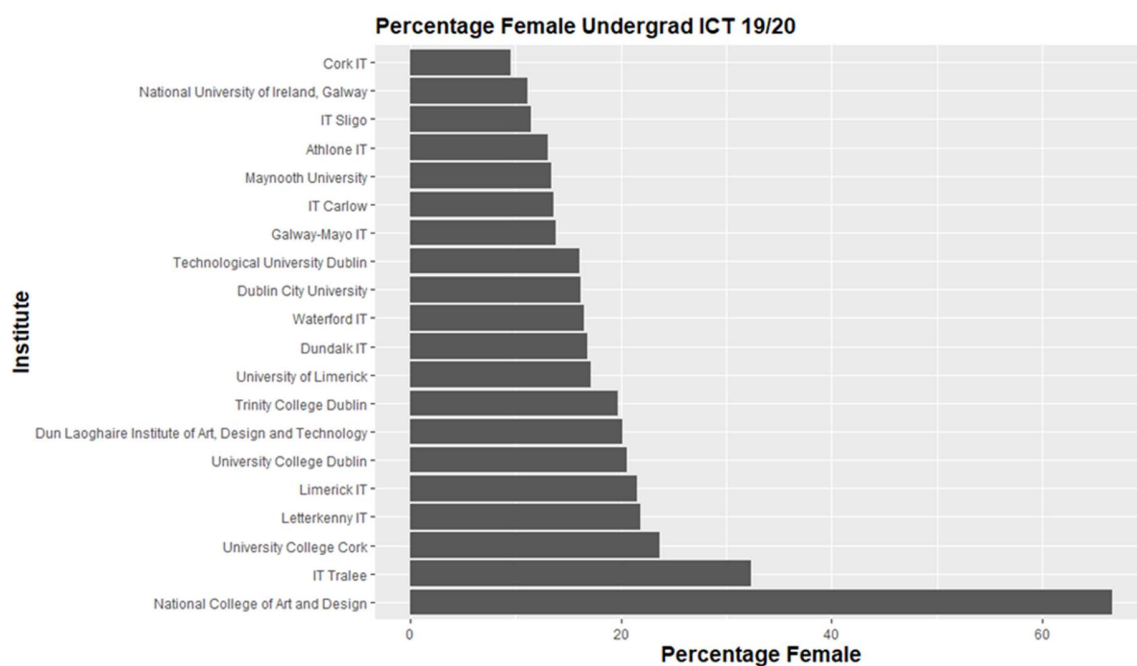
**Figure 1: Percentage Female Undergraduate ICT Students for 2018/2019**



**Table 2: Percentage Female Students Enrolled in Undergraduate ICT Courses 2019/2020**

Institute	Female	Male	Other	Total	Percent Female
Cork IT	61	577	0	638	9.6
National University of Ireland, Galway	30	240	0	270	11.1
IT Sligo	34	262	0	296	11.5
Athlone IT	43	285	0	328	13.1
Maynooth University	56	361	2	419	13.4
IT Carlow	47	299	0	346	13.6
Galway-Mayo IT	76	475	0	551	13.8
Technological University Dublin	372	1938	0	2310	16.1
Dublin City University	126	652	0	778	16.2
Waterford IT	89	449	0	538	16.5
Dundalk IT	71	352	0	423	16.8
University of Limerick	115	555	0	670	17.2
Trinity College Dublin	92	374	0	466	19.7
Dun Laoghaire Institute of Art, Design and Technology	39	155	0	194	20.1
University College Dublin	117	450	2	569	20.6
Limerick IT	141	515	0	656	21.5
Letterkenny IT	74	264	0	338	21.9
University College Cork	221	714	0	935	23.6
IT Tralee	63	132	0	195	32.3
National College of Art and Design	14	7	0	21	66.7

**Figure 2: Percentage Female Undergraduate ICT Students for 2019/2020**



**Table 3: Comparison of ICT percentage female enrollments across institutes between 2018/19 and 2019/20 (sorted alphabetically)**

Institute	2018/19 %Female	2019/20 %Female	Difference (%)
Athlone IT	13.4	13.1	-0.3
Cork IT	11.1	9.56	-1.54
DCU	14.1	16.2	+2.1
IADT	21.3	20.1	-1.2
Dundalk IT	13.8	16.8	+3.0
GMIT	20.3	13.8	-6.5
IT Carlow	11.8	13.6	+1.8
IT Sligo	10.9	11.5	+0.6
IT Tralee	35.4	32.3	-3.1
Letterkenny IT	14.0	21.9	+7.9
LIT	23.2	21.5	-1.7
Maynooth Uni	14.6	13.4	-1.2
NCAD	47.1	66.7	+19.6
NUIG	11.1	11.1	0
TCD	19.9	19.7	-0.2
TU Dublin	15.9	16.1	+0.2
UCC	22.8	23.6	+0.8
UCD	16.7	20.6	+3.9
UL	17.2	17.2	0
Waterford IT	17.4	16.5	-0.9

- The National College of Art and Design (NCAD) is consistently the highest ranking in terms of percentage of female students enrolled in their undergraduate ICT courses. However, the percentages are derived from a very small sample of students.
- Considering the Atlantic gateway, NUI Galway have an 11.1% female, UL have 17.2% and University College Cork have 23.2%.
- UL falls just short of the overall percentage female students attending undergraduate ICT courses nationally both years at 17.2% with the mean being 18.6% (95% CI: 14.7, 22.5) for the year 2018/19 and 19.8% (95%CI: 14.4, 25.1) for 2019/20.
- The average change in percentage female students over the two years is only +1.16%, out of which GMIT and IT Tralee have the largest decrease in percent.

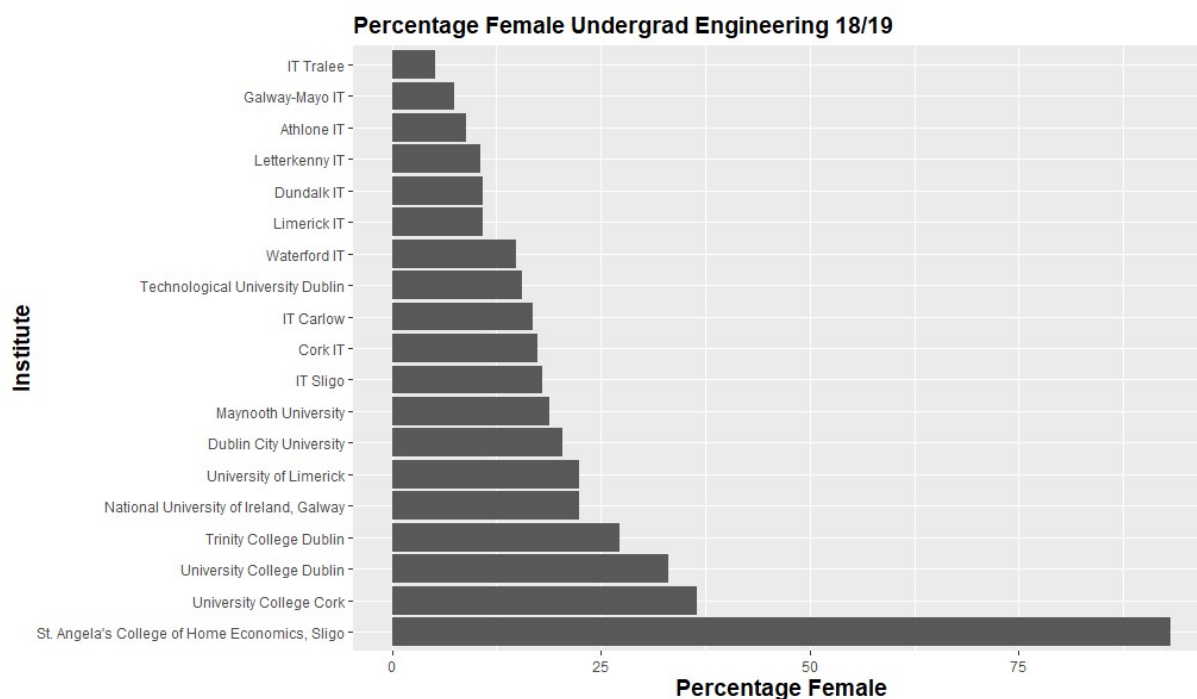
### 3.2 Engineering, Manufacturing & Construction

**Table 4: Percentage Female Students Enrolled in Undergraduate Engineering, Manufacturing & Construction Courses 2018/2019**

Institute	Female	Male	Other	Total	Percent Female
IT Tralee	12	222	0	234	5.1
Galway-Mayo IT	98	1210	0	1308	7.5
Athlone IT	34	347	0	381	8.9
Letterkenny IT	37	312	0	349	10.6
Dundalk IT	61	501	0	562	10.9
Limerick IT	170	1393	0	1563	10.9
Waterford IT	110	628	0	738	14.9
Technological University Dublin	762	4144	0	4906	15.5
IT Carlow	178	879	0	1057	16.8
Cork IT	445	2114	0	2559	17.4
IT Sligo	118	539	0	657	18.0
Maynooth University	64	276	0	340	18.8
Dublin City University	133	519	0	652	20.4
National University of Ireland, Galway	252	876	0	1128	22.3
University of Limerick	381	1325	0	1706	22.3
Trinity College Dublin	265	709	0	974	27.2
University College Dublin	509	1029	3	1541	33.0
University College Cork	338	588	0	926	36.5
St. Angela's College of Home Economics, Sligo	54	4	0	58	93.1



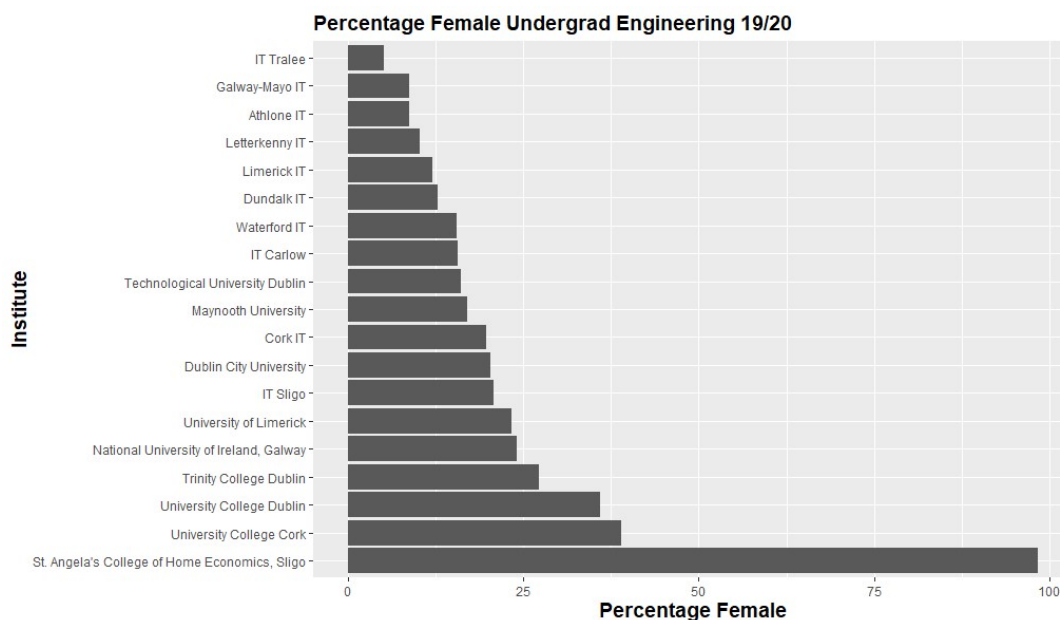
**Figure 3: Percentage Female Undergraduate Engineering, Manufacturing & Construction Students for 2018/2019**



**Table 5: Percentage Female Students Enrolled in Undergraduate Engineering, Manufacturing & Construction Courses 2019/2020**

Institute	Female	Male	Other	Total	Percent Female
IT Tralee	12	220	0	232	5.2
Athlone IT	37	384	0	421	8.8
Galway-Mayo IT	121	1258	0	1379	8.8
Letterkenny IT	38	330	0	368	10.3
Limerick IT	205	1500	0	1705	12.0
Dundalk IT	80	543	0	623	12.8
Waterford IT	120	654	0	774	15.5
IT Carlow	165	891	0	1056	15.6
Technological University Dublin	795	4135	4	4934	16.1
Maynooth University	55	268	0	323	17.0
Cork IT	571	2332	0	2903	19.7
Dublin City University	123	483	0	606	20.3
IT Sligo	124	472	0	596	20.8
University of Limerick	421	1382	0	1803	23.3
National University of Ireland, Galway	268	848	0	1116	24.0
Trinity College Dublin	275	734	0	1009	27.3
University College Dublin	579	1024	4	1607	36.0
University College Cork	382	598	0	980	39.0
St. Angela's College of Home Economics, Sligo	56	1	0	57	98.2

**Figure 4: Percentage Female Undergraduate Engineering, Manufacturing & Construction Students for 2019/2020**



**Table 6: Comparison of Engineering, Manufacturing & Construction percentage female enrollments across institutes between 2018/19 and 2019/20 (sorted alphabetically)**

Institute	18/19 %Female	19/20 %Female	Difference (%)
Athlone IT	8.92	8.79	-0.13
Cork IT	17.4	19.7	+2.3
DCU	20.4	20.3	-0.1
Dundalk IT	10.9	12.8	+1.9
GMIT	7.49	8.77	+1.28
IT Carlow	16.8	15.6	-1.2
IT Sligo	18.0	20.8	+2.8
IT Tralee	5.13	5.17	+0.04
Letterkenny IT	10.6	10.3	-0.3
LIT	10.9	12.0	+1.1
Maynooth University	18.8	17.0	-1.8
NUIG	22.3	24.0	+1.7
TCD	27.2	27.3	+0.1
TU Dublin	15.5	16.1	+0.6
UCC	36.5	39.0	+2.5
UCD	33.0	36.0	+3.0
UL	22.3	23.3	+1
Waterford IT	14.9	15.5	+0.6
St. Angela's	93.1	98.2	+5.1

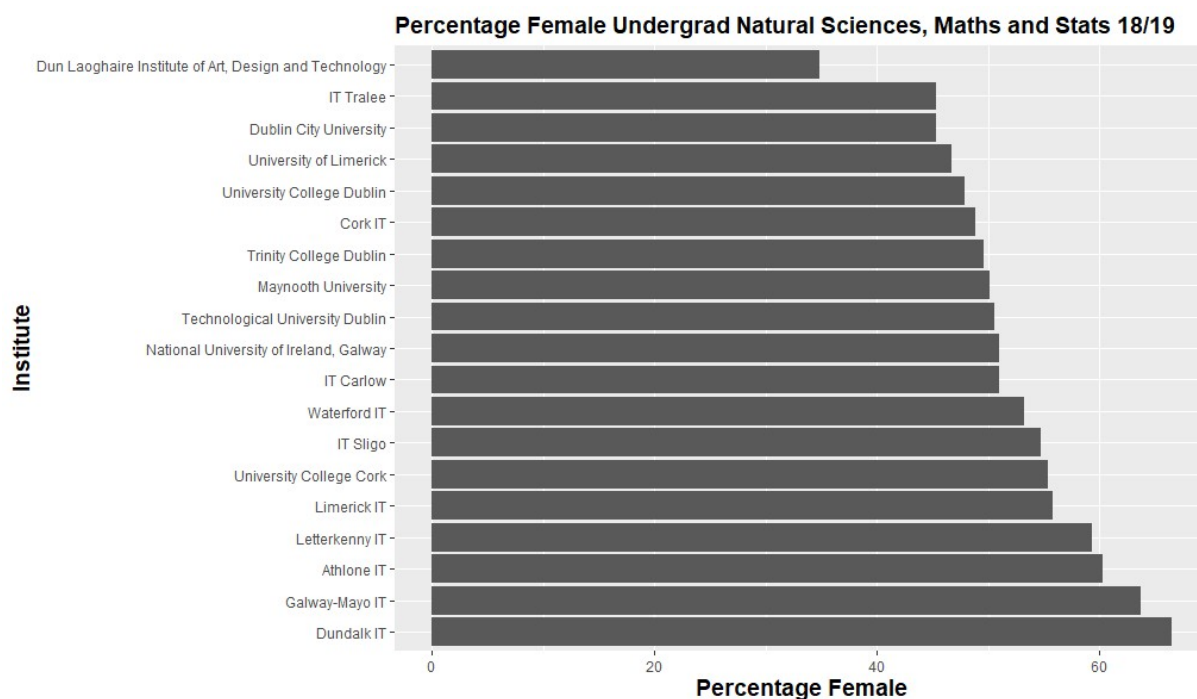
- St. Angela's College is the highest ranking in terms of percentage of female students in their undergraduate Engineering, Manufacturing and Construction courses. However, due to the small number of students enrolled and the undergraduate courses offered it is clear they are a major outlier in comparison to the other institutes.
- NUI Galway has 23.2% female students and University College Cork has a higher percentage of 37.8% while UL falls below both at only 22.8% female.
- UL lies above the overall percentage female students attending all undergraduate Engineering, Manufacturing and Construction courses both years at an average of 22.8% with the mean being 21.6% (95% CI: 12.9, 30.2) for the year 2018/19 and 22.7% (95%CI: 13.5,31.8) for 2019/20.

### 3.2 Natural Sciences, Mathematics & Statistics

**Table 7: Percentage Female Students Enrolled in Undergraduate Natural Sciences, Maths & Stats Courses 2018/2019**

Institute	Female	Male	Other	Total	Percent Female
Dun Laoghaire Institute of Art, Design and Technology	8	15	0	23	34.8
IT Tralee	130	157	0	287	45.3
Dublin City University	517	623	0	1140	45.4
University of Limerick	574	654	0	1228	46.7
University College Dublin	1021	1107	5	2133	47.9
Cork IT	465	487	0	952	48.8
Trinity College Dublin	930	946	0	1876	49.6
Maynooth University	735	727	3	1465	50.2
Technological University Dublin	1314	1286	0	2600	50.5
IT Carlow	102	98	0	200	51.0
National University of Ireland, Galway	1176	1130	0	2306	51.0
Waterford IT	226	199	0	425	53.2
IT Sligo	163	135	0	298	54.7
University College Cork	1242	1002	0	2244	55.3
Limerick IT	238	189	0	427	55.7
Letterkenny IT	89	61	0	150	59.3
Athlone IT	291	192	0	483	60.2
Galway-Mayo IT	497	283	0	780	63.7
Dundalk IT	125	63	0	188	66.5

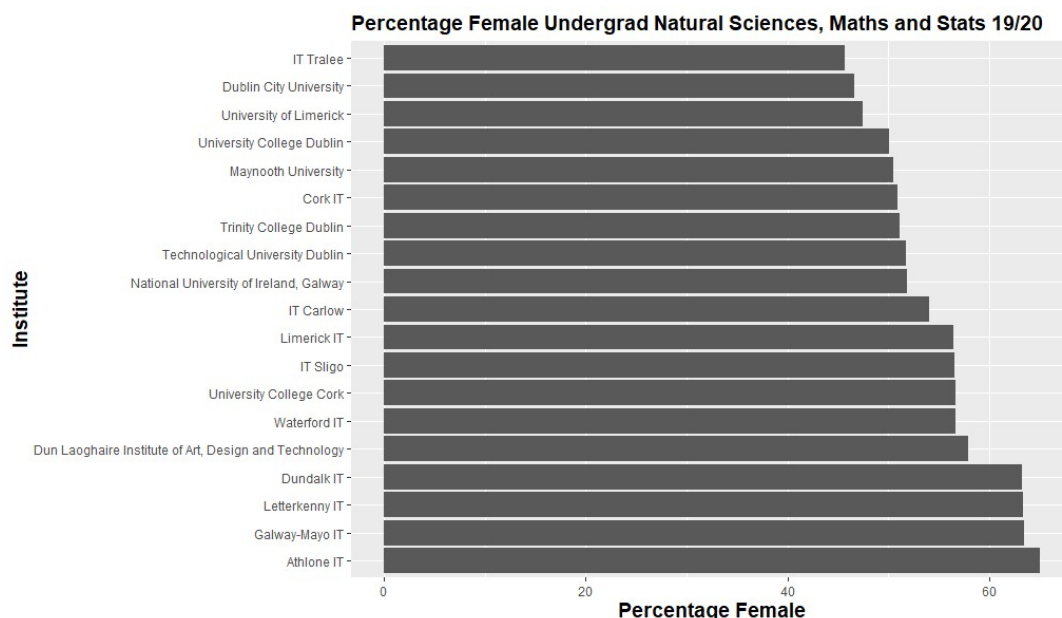
**Figure 5: Percentage Female Undergraduate Natural Sciences, Maths and Stats Students for 2018/2019**



**Table 8: Percentage Female Students Enrolled in Undergraduate Natural Sciences, Maths & Stats Courses 2019/2020**

Institute	Female	Male	Other	Total	Percent Female
IT Tralee	139	165	0	304	45.7
Dublin City University	462	529	0	991	46.6
University of Limerick	585	648	0	1233	47.4
University College Dublin	1102	1092	5	2199	50.1
Maynooth University	739	723	1	1463	50.5
Cork IT	489	472	0	961	50.9
Trinity College Dublin	957	917	0	1874	51.1
National University of Ireland, Galway	1237	1149	0	2386	51.8
Technological University Dublin	1311	1220	1	2532	51.8
IT Carlow	100	85	0	185	54.1
IT Sligo	165	127	0	292	56.5
Limerick IT	258	199	0	457	56.5
University College Cork	1241	949	1	2191	56.6
Waterford IT	268	205	0	473	56.7
Dun Laoghaire Institute of Art, Design and Technology	11	8	0	19	57.9
Dundalk IT	127	74	0	201	63.2
Letterkenny IT	88	51	0	139	63.3
Galway-Mayo IT	508	293	0	801	63.4
Athlone IT	277	149	0	426	65.0

**Figure 6: Percentage Female Undergraduate Natural Sciences, Maths and Stats Students for 2019/2020**



**Table 9: Comparison of Natural Sciences, Maths and Stats percentage female enrollments across institutes between 2018/19 and 2019/20 (sorted alphabetically)**

Institute	2018/19 %Female	2019/20 %Female	Difference (%)
Athlone IT	60.2	65.0	+4.8
Cork IT	48.8	50.9	+2.1
DCU	45.4	46.6	+1.2
Dundalk IT	66.5	63.2	-3.3
GMIT	63.7	63.4	-0.3
IT Carlow	51.0	54.1	+3.1
IT Sligo	54.7	56.5	+1.8
IT Tralee	45.3	45.7	+0.4
Letterkenny IT	59.3	63.3	+4.0
LIT	55.7	56.5	+0.8
Maynooth University	50.2	50.5	+0.3
NUIG	51.0	51.8	+0.8
TCD	49.6	51.1	+1.5
TU Dublin	50.5	51.8	+1.3
UCC	55.3	56.6	+1.3
UCD	47.9	50.1	+2.2
UL	46.7	47.4	+0.7
Waterford IT	53.2	56.7	+3.5
IADT	34.8	57.9	+23.1

- This broad field of study shows a much higher range of percentage female students in all Natural Sciences, Maths and Stats undergraduate courses compared to the two presented earlier in the report.
- However, at 47.1% female student UL is placed towards the bottom of the list and outside of the 95% confidence intervals for this data: 2018/19- (95% CI: 48.8, 55.4), 2019/20- (95% CI: 52.02, 57.4).

### 3.4 Summary

Table 10 gives a clear comparison of UL's percentage female students in each of the three fields of study analysed in this report.

**Table 10: University of Limerick Percentage Female Students**

Broad field of study	2018/19	2019/20
ICT	17.2	17.2
Engineering, Manufacturing & Construction	22.3	23.3
Natural Sciences, Maths & Stats	46.7	47.4

Table 10 shows the broad field of study "Natural Sciences, Maths & Stats" to be more popular amongst female students compared to ICT and Engineering, Manufacturing & Construction.

## 4. Analysis of enrollment in undergraduate honours degrees offered in universities only under Broad fields of study ICT, Engineering, Manufacturing & Construction and Natural Sciences, Mathematics & Statistics

This section discusses the numbers of enrollments into undergraduate honours degrees in Universities in the ICT field of study and the percentage female students at each. IT Tralee has been included here because the previous analysis of all undergraduate ICT courses found that IT Tralee had very high percentage female students for both years at 33.9% female.

**Table 11: Percentage Female Students Enrolled in ICT Honours Degrees in University Only 2018/2019**

Institute	Female	Male	Total	Percent Female
National University of Ireland, Galway	28	220	248	11.3
Dublin City University	111	678	789	14.1
Maynooth University	59	346	405	14.6
Technological University Dublin	242	1319	1561	15.5
University College Dublin	82	408	490	16.7
University of Limerick	114	547	661	17.2
Trinity College Dublin	92	371	463	19.9
IT Tralee	21	74	95	22.1
University College Cork	200	681	881	22.7

**Table 12: Percentage Female Students Enrolled in ICT Honours Degrees in University Only 2019/2020**

Institute	Female	Male	Other	Total	Percent Female
National University of Ireland, Galway	27	227	0	254	10.6
Maynooth University	56	361	2	417	13.4
Dublin City University	126	652	0	778	16.2
Technological University Dublin	254	1283	0	1537	16.5
University of Limerick	115	555	0	670	17.2
Trinity College Dublin	92	374	0	466	19.7
University College Dublin	117	450	2	567	20.6
IT Tralee	19	70	0	89	21.3
University College Cork	220	714	0	934	23.6

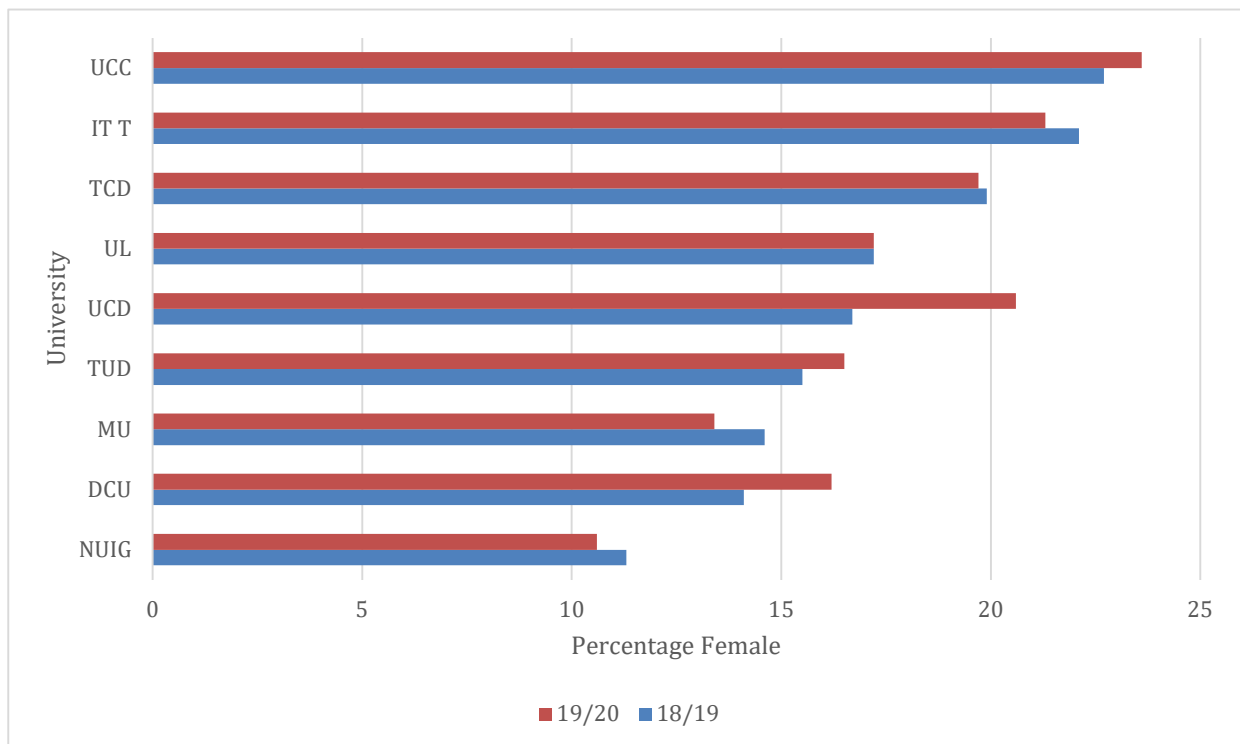
- It is clear from tables 11 and 12 that when only honours degrees are considered, IT Tralee<sup>3</sup> shows a lower percentage of 21.7%. However, they continue to sit close to the top of the table with higher percentages than all but one university, UCC, at an average of 23.2%.
- Comparison shows that all undergraduate ICT courses at UL are honours degrees as the percentage female students remained at 17.2% throughout the analysis and total enrollment numbers do not differ between all undergraduate and honours degrees only.
- However, 95% confidence intervals for this data: 2018/19- (14.6, 19.6), 19/20-(15.1, 20.3), are smaller in width and so UL at 17.2% falls closer to the overall percentage female students: 2018/19- 17.1%, 2019/20- 17.7% for honours degrees only.

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<sup>3</sup> IT Tralee has been included here as previous analysis of all undergraduate ICT courses found IT Tralee had a very high percentage of female students for both years.

- Figure 7 is an effective way to visualize the comparison of percentage female students in ICT honours degrees in IT Tralee and Irish universities for the academic years 2018/19 and 2019/20.

**Figure 7: Yearly Comparison between Percentage Female Students Enrolled in ICT Honours Degrees in Universities only**



**Table 13: Percentage Female Students Enrolled in Engineering, Manufacturing and Construction Honours Degrees in University Only 2018/2019**

Institute	Female	Male	Other	Total	Percent Female
Maynooth University	64	276	0	340	18.8
Technological University Dublin	495	1970	0	2465	20.1
Dublin City University	132	495	0	627	21.1
National University of Ireland, Galway	224	823	0	1047	21.4
University of Limerick	374	1304	0	1678	22.3
Trinity College Dublin	265	709	0	974	27.2
University College Dublin	432	951	3	1386	31.2
University College Cork	293	516	0	809	36.2

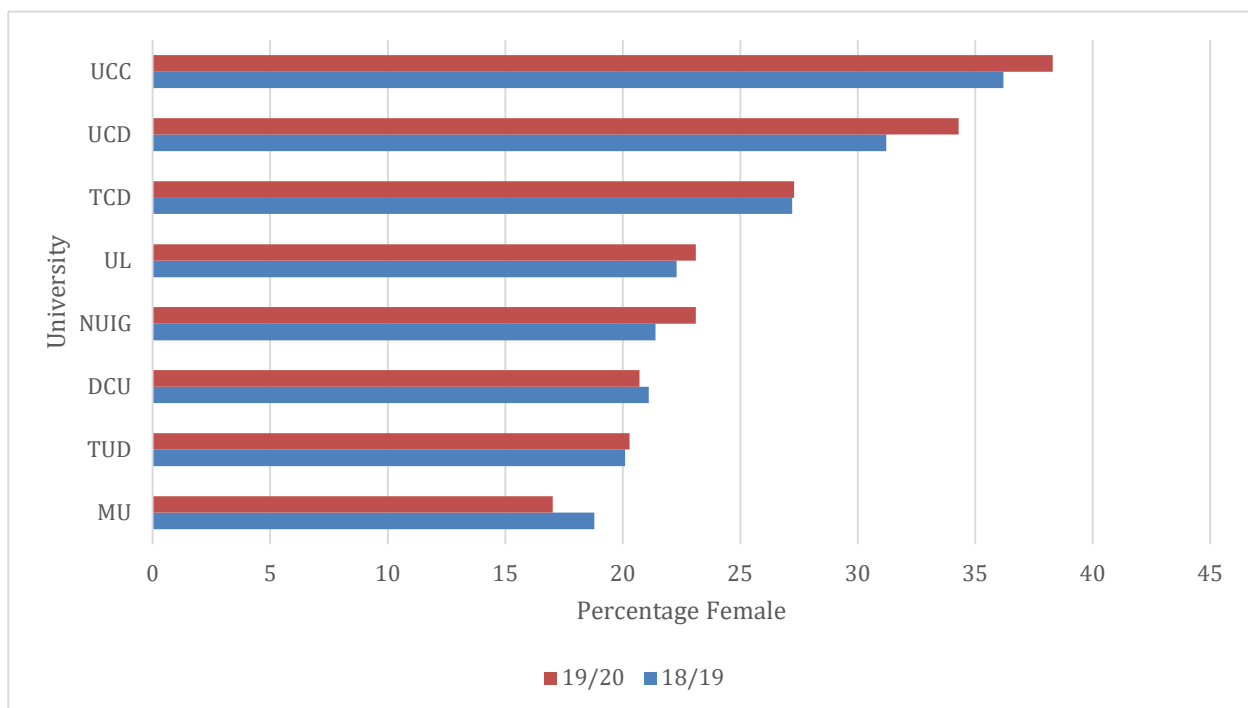


**Table 14: Percentage Female Students Enrolled in Engineering, Manufacturing and Construction Honours Degrees in University Only 2019/2020**

Institute	Female	Male	Other	Total	Percent Female
Maynooth University	55	268	0	323	17.0
Technological University Dublin	520	2039	4	2563	20.3
Dublin City University	123	471	0	594	20.7
National University of Ireland, Galway	240	799	0	1039	23.1
University of Limerick	403	1345	0	1748	23.1
Trinity College Dublin	275	734	0	1009	27.3
University College Dublin	501	955	3	1459	34.3
University College Cork	343	553	0	896	38.3

- UL have the fourth highest percentage female students in Engineering Honours Degrees.
- In comparison to the overall percentage female students: 18/19-24.8%, 19/20-25.5%, UL falls below overall percentage for both years analysed. Only three universities reached above the overall percentages for the two years: UCC, UCD and TCD.
- UCC and UCD are continuous with the high percentage of female students for the two years as well as both increasing the percentage from one year to the next.

**Figure 8: Yearly Comparison between Percentage Female Students Enrolled in Engineering, Manufacturing & Construction Honours Degrees in Universities only**



**Table 15: Percentage Female Students Enrolled in Natural Sciences, Maths and Stats Honours Degrees in University Only 2018/2019**

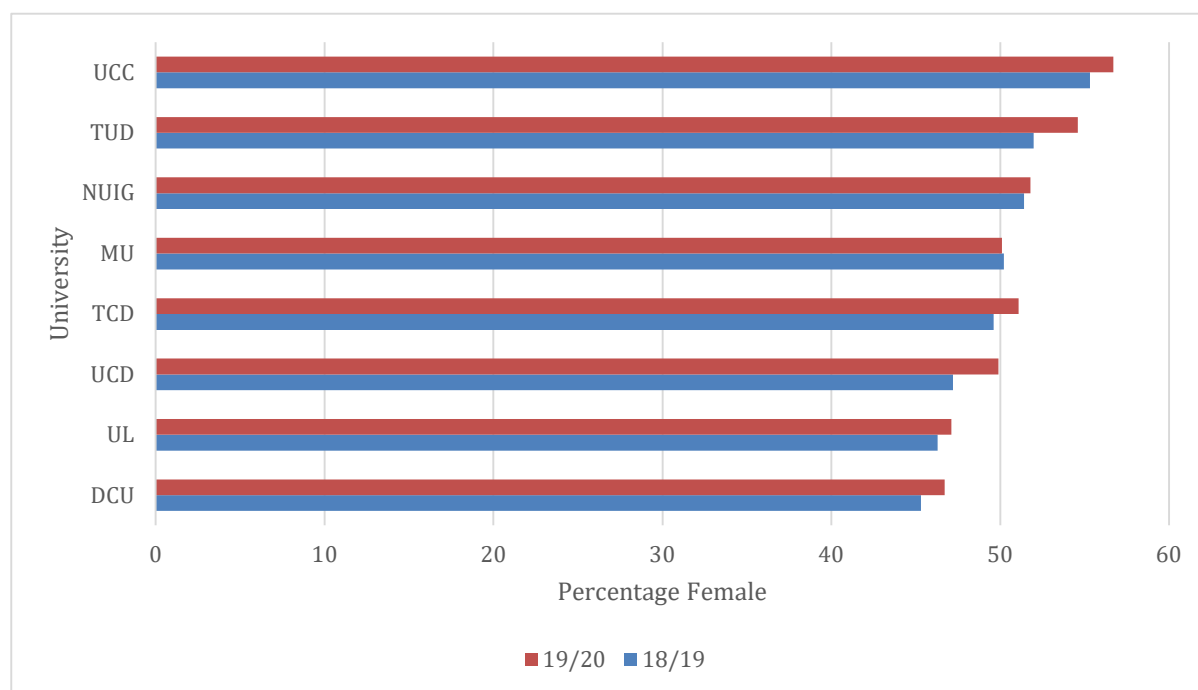
Institute	Female	Male	Other	Total	Percent Female
Dublin City University	516	622	0	1138	45.3
University of Limerick	562	651	0	1213	46.3
University College Dublin	946	1054	5	2005	47.2
Trinity College Dublin	930	946	0	1876	49.6
Maynooth University	727	717	3	1447	50.2
National University of Ireland, Galway	1150	1086	0	2236	51.4
Technological University Dublin	525	485	0	1010	52.0
University College Cork	1210	977	0	2187	55.3

**Table 16: Percentage Female Students Enrolled in Natural Sciences, Maths and Stats Honours Degrees in University Only 2019/2020**

Institute	Female	Male	Other	Total	Percent Female
Dublin City University	461	527	0	988	46.7
University of Limerick	575	646	0	1221	47.1
University College Dublin	1031	1030	5	2066	49.9
Maynooth University	736	713	1	1450	50.8
Trinity College Dublin	957	917	0	1874	51.1
National University of Ireland, Galway	1190	1106	0	2296	51.8
Technological University Dublin	557	463	0	1020	54.6
University College Cork	1205	919	1	2125	56.7

- UL falls close to the bottom of the rankings here of percentage female students in Natural Sciences, Maths & Stats Honours Degrees, however there are only 10 percentage points between the highest and lowest institute.
- In contrast to the overall percentage female students in this broad field of study: 2018/19-49.7%, 2019/20-51.1%, UL is below the overall percentage for both years analysed. Only one university sits below UL on the list for the two years, DCU.
- Four universities sit above average for both years: UCC, TUD, NUIG, MU.
- Figure 9 is an effective way to visualize the comparison of percentage female students in Engineering honours degrees in Irish universities for the academic years 2018/19 and 2019/20.
- UCC and UCD are highest in each of the 2 years, with the high percentage of female students for the two years as well as both increasing the percentage from one year to the next.

**Figure 9: Yearly Comparison between Percentage Female Students Enrolled in Natural Sciences, Maths & Stats Honours Degrees in Universities only**



## 5. Summary

This project demonstrated that R can be effectively used to extract data from the HEA website, and to convert it to tables and graphs which are useable for Athena SWAN reports and other purposes.

Analysis of this data for specific cohorts has been completed. There are many other ways that this data available from the HEA can be analysed, including by detailed field of study, age group, mode of delivery and country of origin.

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