An Analysis of Introductory University Programming Courses in the UK

Ellen Murphy
Institute for
Mathematical Innovation
University of Bath
e.murphy@bath.ac.uk

Tom Crick
Dept. of Computing
Cardiff Metropolitan University
tcrick@cardiffmet.ac.uk

James H. Davenport
Dept. of Computer Science
University of Bath
j.h.davenport@bath.ac.uk

ABSTRACT

This paper reports the results of a survey of xx introductory programming courses delivered at UK universities as part of their first year computer science (or similar) degree programmes, conducted in the first half of 2016. Results of this survey are compared with a related survey conducted since 2010 (as well as earlier surveys from 2001 and 2003) on universities in Australia and New Zealand. Trends in student numbers, programming paradigm, programming languages and environment/tools used, as well as the reasons for choice of such are reported. Other aspects of first programming courses such as instructor experience, external delivery of courses and resources given to students are also examined.

The results indicate a trend towards...

Categories and Subject Descriptors

K.3.2 [**Computers & Education**]: Computer and Information Science Education—*Computer Science Education*; K.4.1 [**Computers And Society**]: Public Policy Issues

Keywords

Introductory Programming, Programming Languages, Programming Environments, Computer Science Education, Higher Education, Tertiary Education, UK

1. INTRODUCTION

[8] is the latest in a long line [12, 9] of papers surveying the teaching of introductory programming courses in Australasia. However, such surveys are not the norm elsewhere, and this paper reports the authors' findings from runningthe first such survey in the United Kingdom.

UK policy context e.g. schools [1, 2], Shadbolt/Wakeham, TEF, graduate employability, etc.

Other work in this space [10, 7, 4, 11, 6]

Also, our previous work [3, 5].

2. METHODOLOGY

2.1 Recruitment of Participants

To recruit participants for the survey, a general invitation email was sent to the Council of Professors and Heads of Computing (CPHC) mailing list. CPHC have members from over 100 UK universities, and are the representational body for this group in the UK[1].The invitation asked for the survey to be passed on to the most appropriate person to fill it out; Director of Studies, Chair of Teaching Committee or the best fit for the individual institution.

The survey was hosted online, and was open from mid-May until the end of June 2016, at which point it was closed and the results were downloaded and analysed.

2.2 Questions

The questions used in the survey were generously provided by the authors of [8], so as to allow direct comparison between the results of this survey and that of the Australian/New Zealand 2014 survey. Where possible, questions were left unchanged, although a small minority were edited to reflect the UK target audience.

As written in [8], text in the survey made clear that the terminology "course" was used for "the basic unit of study that is completed by students towards a degree, usually studied over a period pf a semester or session, in conjunction with other units of study".

The first section of the survey asked about the programming language(s) in use, the reasons for their choice, and the perceived difficulty of usefulness of the programming language(s). Following this were questions regarding the use of environments or development tools; which ones were used, the reasons for their choice and the perceived difficulty. General questions about paradigm, instructor experience and external delivery were asked, along with questions regarding students receiving unauthorised assistance, and the resources provided to students. Finally, participants were asked to identify their top three main aims when teaching introductory programming, and were also allowed to provide further comments.

In [8], participants were asked to rank the importance of the given reasons for choosing a programming language, environment or tool. Due to technical limitations in online survey tool used, it was not possible to do so in this survey.

3. RESULTS AND DISCUSSION

3.1 Universities and Courses

[1] https://cphc.ac.uk/who-we-are/

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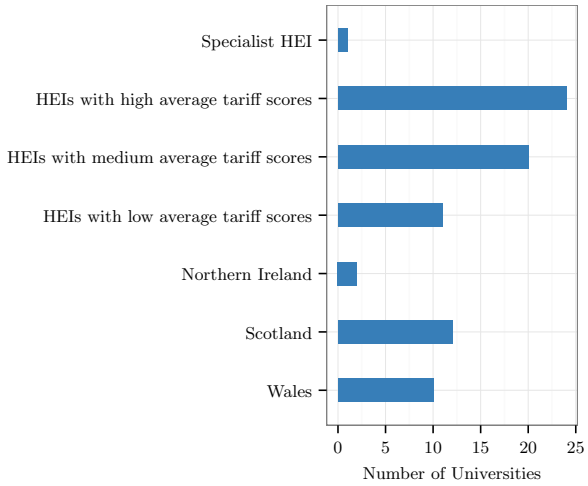

Figure 1: The number of universities per Tariff Group.

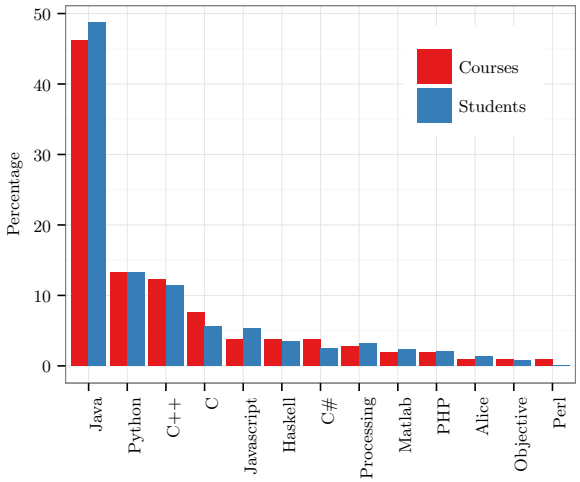

Figure 2: Language popularity by percentage of courses and students.

Table 1: The number of programming languages used in first programming courses.

Languages	1	2	3	4
Courses	59	17	3	1

3.2 Student Numbers

3.3 Languages

3.4 Instructor Experience

3.5 IDEs and Tools

3.6 Other Aspects of the Course

3.7 Aims of an Introductory Programming Course

[8] asked their respondents for the aims of their introductory programming course. They asked for (up to) three aims, but ??Ellen: I thought you said they just used one, but looking at the headcount in the firgure, it looks like all three?? in their Figure 15. As part of our policy of reproducing [8] as closely as possible, we asked the same. The authors then attempted to classify the free-text answers into the same categorisation as [8] used. While it is trivial to map the written aim "Thinking algorithmically" to [8]'s "Algorithmic thinking" and so on, many were not so clear: for example, we mapped "To learn a specific language" to "syntax/writing basic code". There were also a class of aims, such as "Establish professional software development practices", that seemed very coherent, but didn't map clearly to

Table 2: The main paradigm in use in the first programming course.

Paradigm	Object-Oriented	Procedural	Functional
Courses	40	27	7

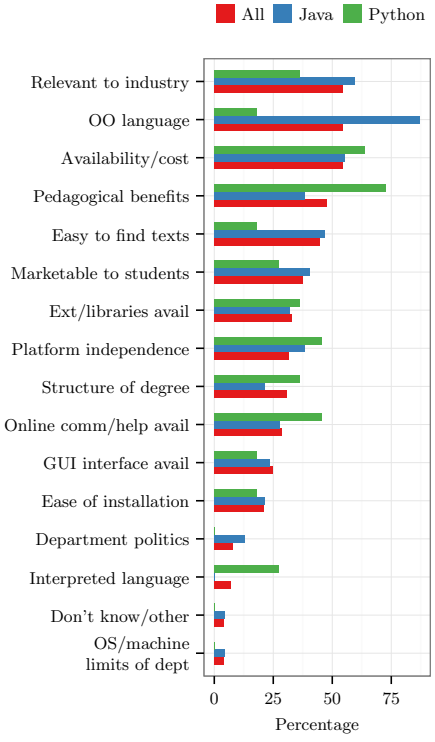

Figure 3: Reasons given for choosing a programming language by percentage for: all languages; Java; and Python.

Table 3: The number of years the instructor has been involved in teaching introductory programming.

Years	<2	2 - 5	5 - 10	10 - 20	20 - 30	>30
Instructors	3	9	9	27	19	7

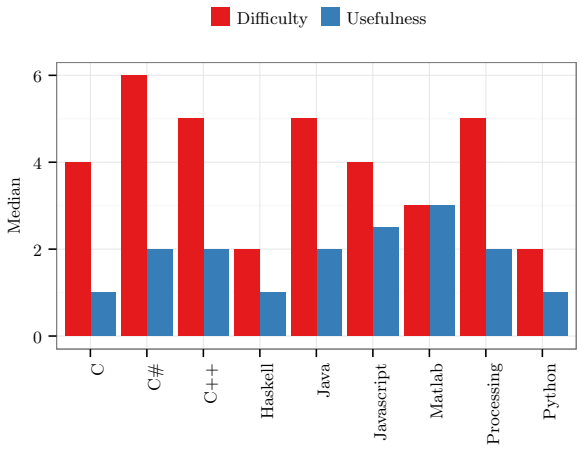

Figure 4: The median of the perceived difficulty and usefulness of language, where 1 is 'extremely easy' and 7 is 'extremely difficult' for difficulty and 1 is 'extremely useful' and 7 is 'extremely useless' for usefulness. Answers must have been given by at least two instructors.

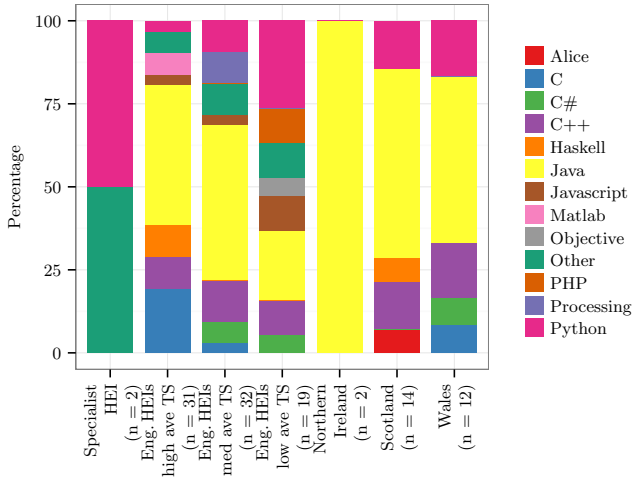

Figure 5: The breakdown of programming languages for each of the Tariff Groups.

Table 4: The number of tools/environments used in first programming courses.

Tools	1	2	3	4	8
Courses	34	15	6	2	1

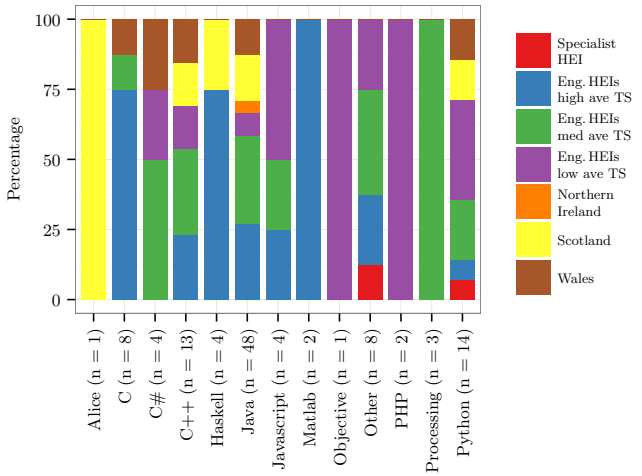

Figure 6: The breakdown of programming languages for each of the Tariff Groups.

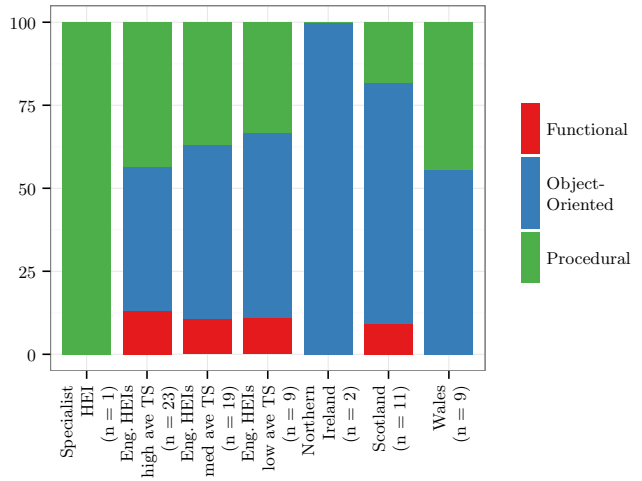

Figure 7:

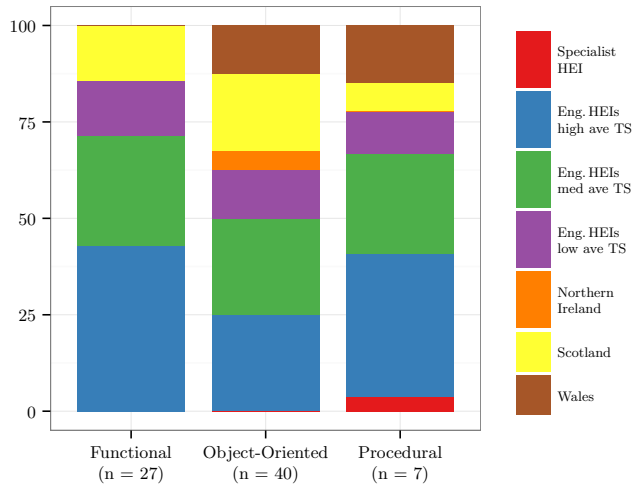

Figure 8:

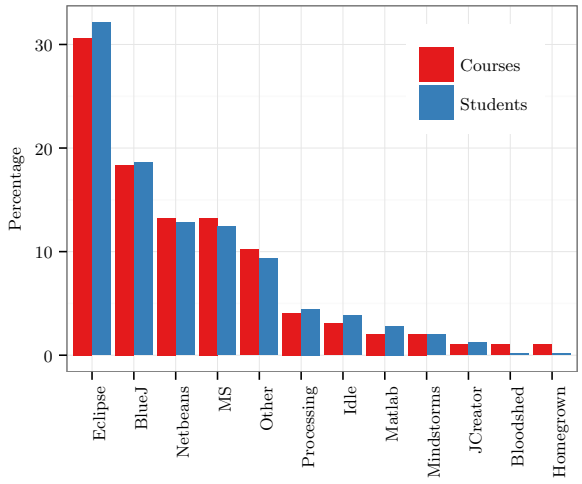

Figure 9: Tool or environment popularity by percentage of courses and students.

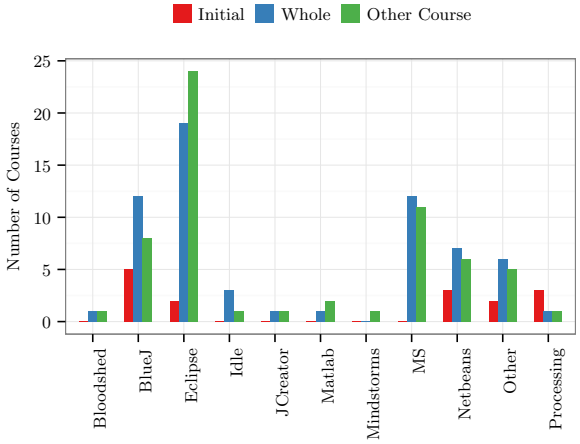

Figure 11: For each tool or environment, whether it is used: for an initial part of the first programming course; throughout the whole of the first programming course; in any other course in the degree.

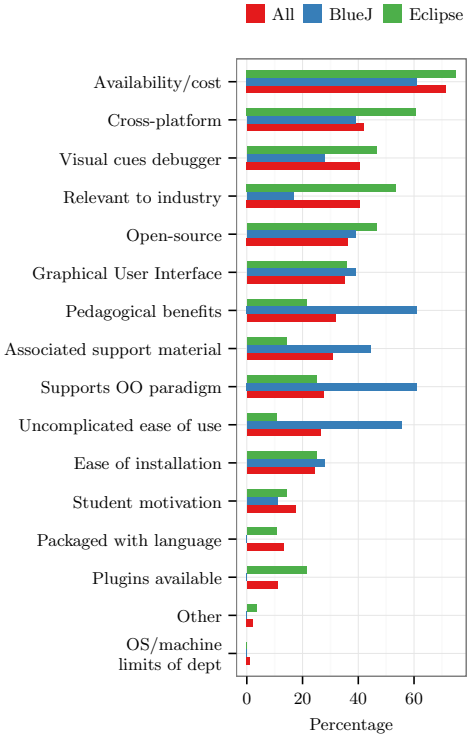

Figure 10: Reasons given for choosing a tool or environment by percentage for: all tools and environments; BlueJ; and Eclipse.

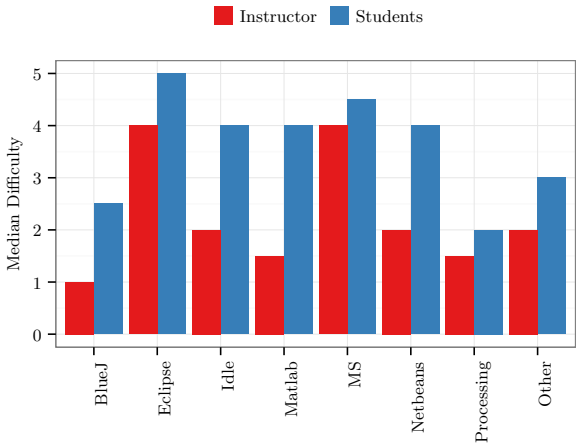

Figure 12: The median difficulty rating of tool/environment for the instructor and students to use, where 1 is 'extremely easy' and 7 is 'extremely difficult'. Answers must have been given by at least two instructors.

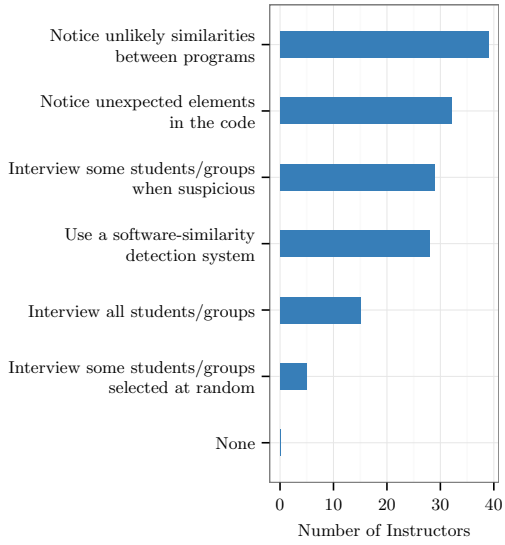

Figure 13: Steps taken to determine whether students have received unauthorised assistance on assignments.

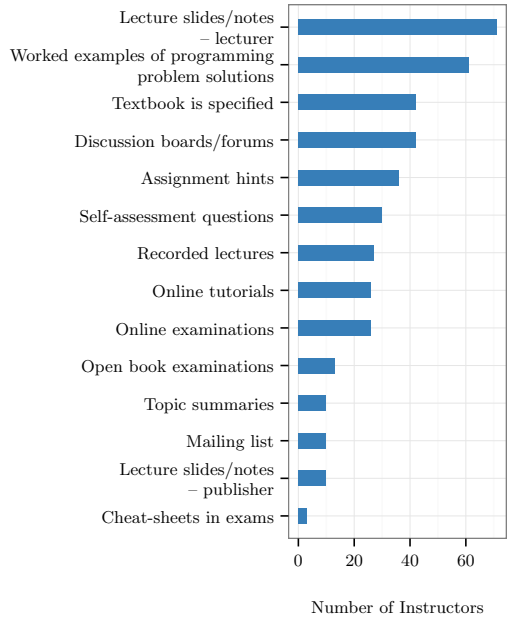

Figure 14: Resources provided to students.

the [8] aims. These we have categorised as "Software Engineering".

4. GENERAL DISCUSSION

4.1 The U.K. context

4.2 Comparison with Australasia

Here we compare with [8], the latest Australasian survey.

5. ACKNOWLEDGEMENTS

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