



Introduction

- Coding is act of **providing instructions to a computer**
- Highly valued transferable skill** in STEM education and careers (Aho et al, 2014)
- Students face barriers in introductory programming** and it is **challenging to implement in higher education** (Serbanescu et al, 2011)

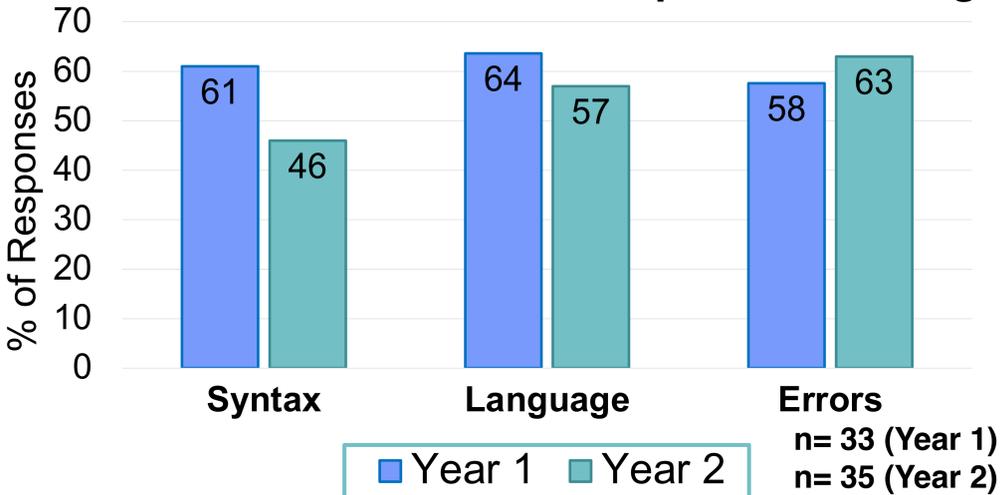
1 What barriers do students face when learning to code within a physics degree?

2 Are there more effective ways of teaching coding to physics students?



Coding barriers

What are the most difficult aspects of coding?



- The three aspects of coding students found most difficult **agree with literature**
- Difficulties** that students face in introductory coding can be categorised into **three themes** (Qian and Lehman, 2017)

Syntactic knowledge

- Knowledge of the **coding language rules**
- Students found it difficult to keep track of **brackets** and correct **indentation**

Conceptual knowledge

- Knowledge of **how the language constructs work**
- Students relied on function documentation particularly for **loops**

Strategic knowledge

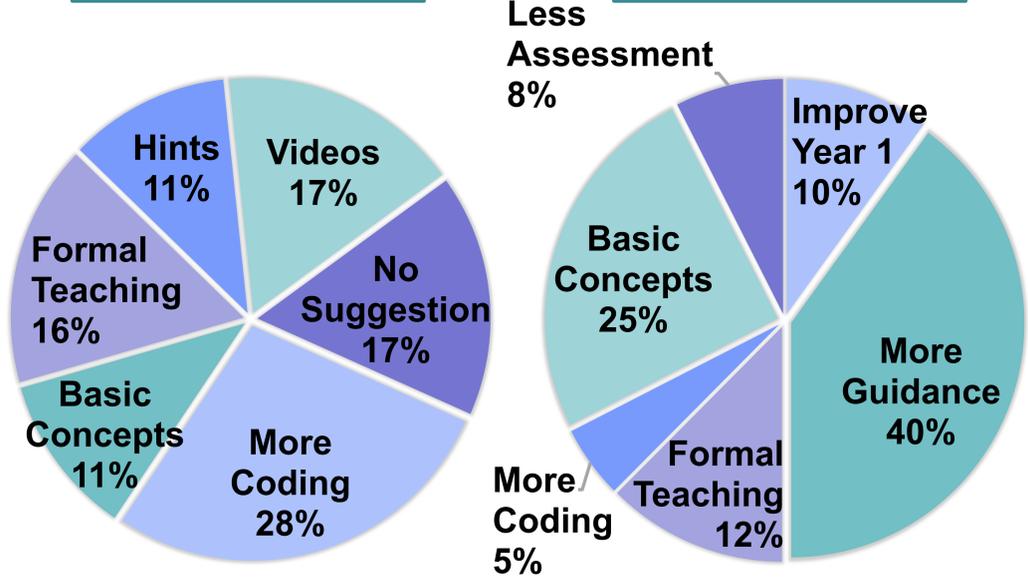
- Knowledge of **debugging and problem-solving**
- Students found **language used to describe errors hard to understand**

Teaching coding

- A factor that affects students confidence and ability to code well is **how they are taught** (Qian and Lehman, 2017)
- Students were asked to provide **teaching suggestions** to help them overcome the difficulties they have:

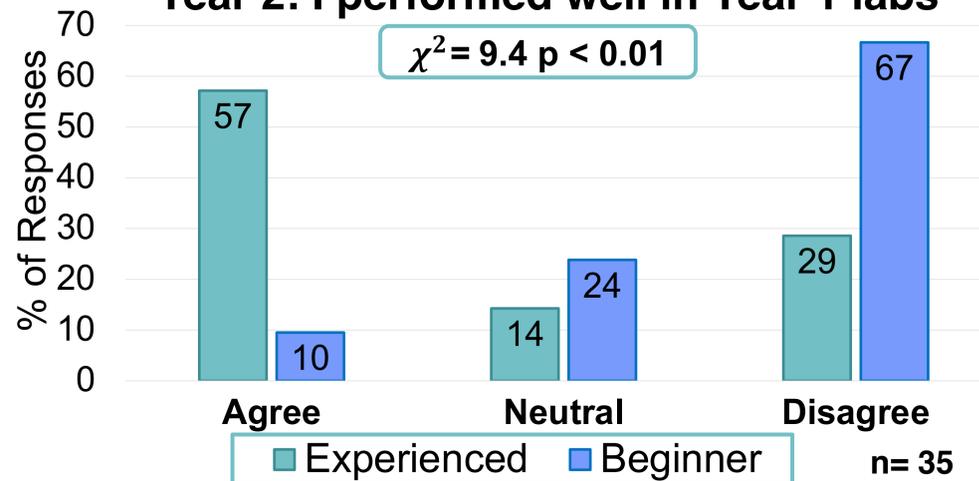
Year 1 suggestions

Year 2 suggestions



Year 1 effect on Year 2

Year 2: I performed well in Year 1 labs



86% of Year 2 students agree that **Year 1 coding labs had not prepared them well** for Year 2 labs

Beginners thought that they **performed poorly** and stated that **prior knowledge was assumed**

Conclusions



By improving students **syntactic** and **conceptual knowledge**, it should be easier for them to enhance strategic knowledge



More time should be allocated to coding, particularly in Year 1; this could be by means of lectures or tutorials



The Year 1 coding labs should **cover the basics fully** and form a solid foundation that can be built upon in later years