Mapping the use of Physical Computing at Key Stage 2 in England

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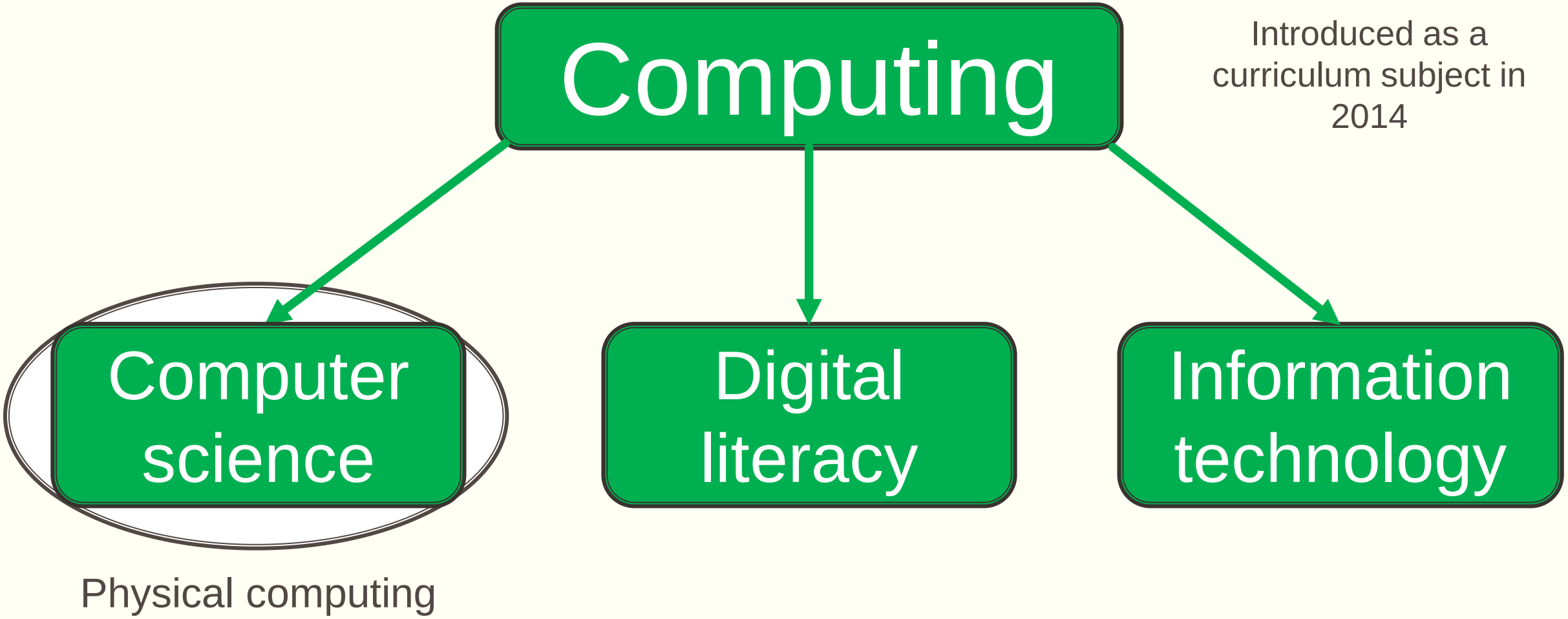
Aims

- Positionality of this research
- Brief methodological overview
- Highlight key findings
- Draw conclusions and recommendations

Computing within the national curriculum



Introduced as a curriculum subject in 2014

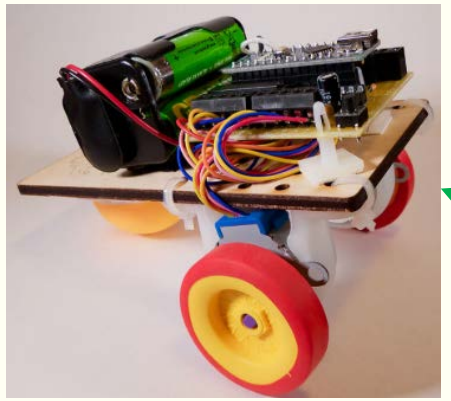
Influences on computing pedagogy

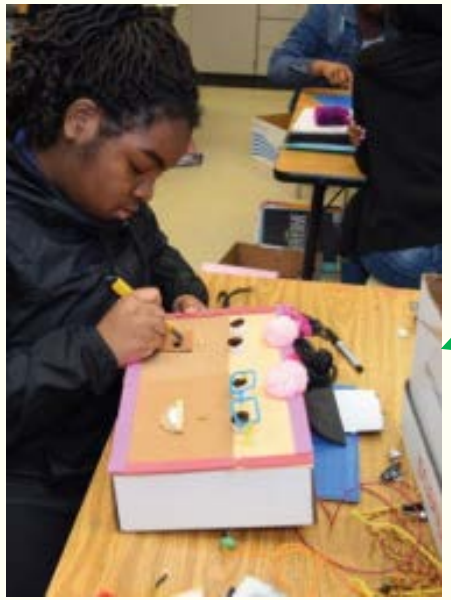
Evidence the sustainability and efficacy of pedagogical contexts (Royal Society 2017)

Plan and deliver learning outcomes within a broad and balanced curriculum (Ofsted 2018)

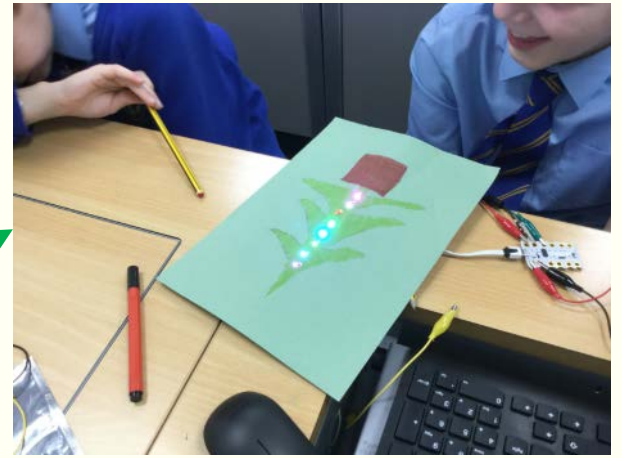
Support for teachers via the National Centre for Computing Education (STEM Learning 2018)

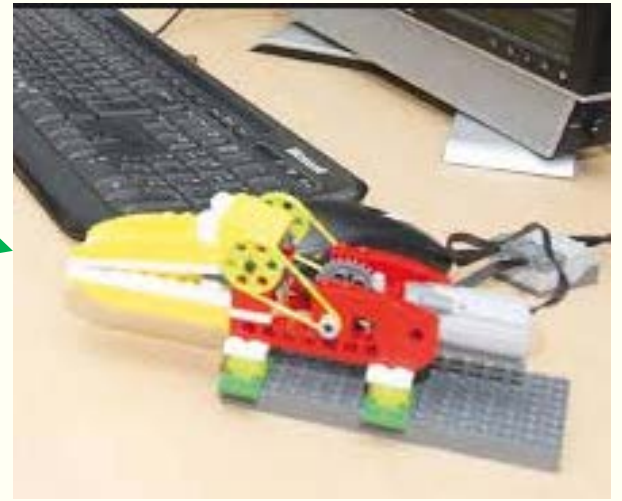
What is physical computing?





Building, creating and programming with both a digital device and software to create something tangible





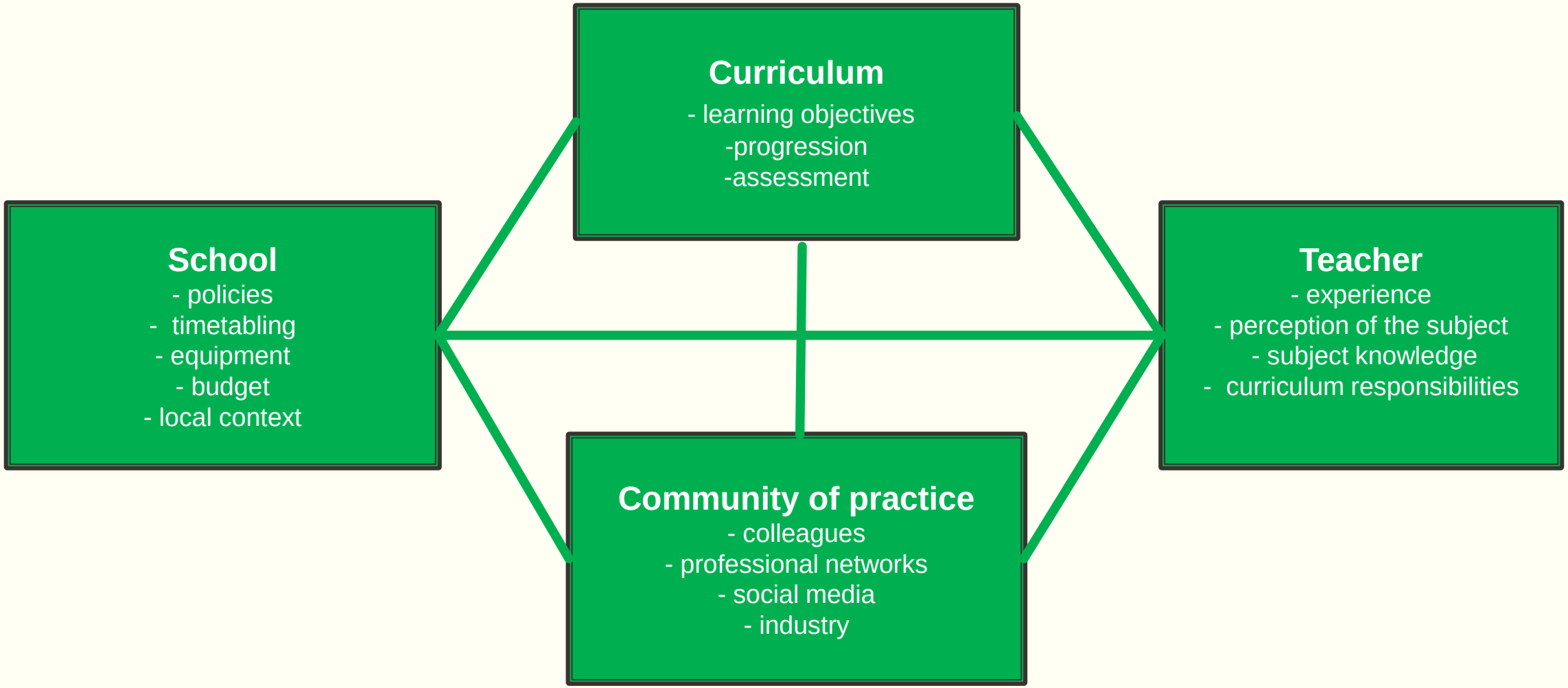
Physical computing and the impact on learning

- Working with tangible devices is engaging (Sentance et al 2017)
- Visibility of code outputs may lead to increased understanding of programming concepts such as sequencing and repetition (Przybylla and Romeike 2018)
- Empirical evidence demonstrating an improvement in learning outcomes is limited (Waite 2017)

Biggest barrier to using physical computing

"Teachers can be blinded by the success of a functioning system at the expense of the classroom pedagogy needed to teach the skills, knowledge and understanding [in computer science] to learners of different abilities and interests." Childs, 2017

How do teachers decide what to include in their plans and schemes of work?



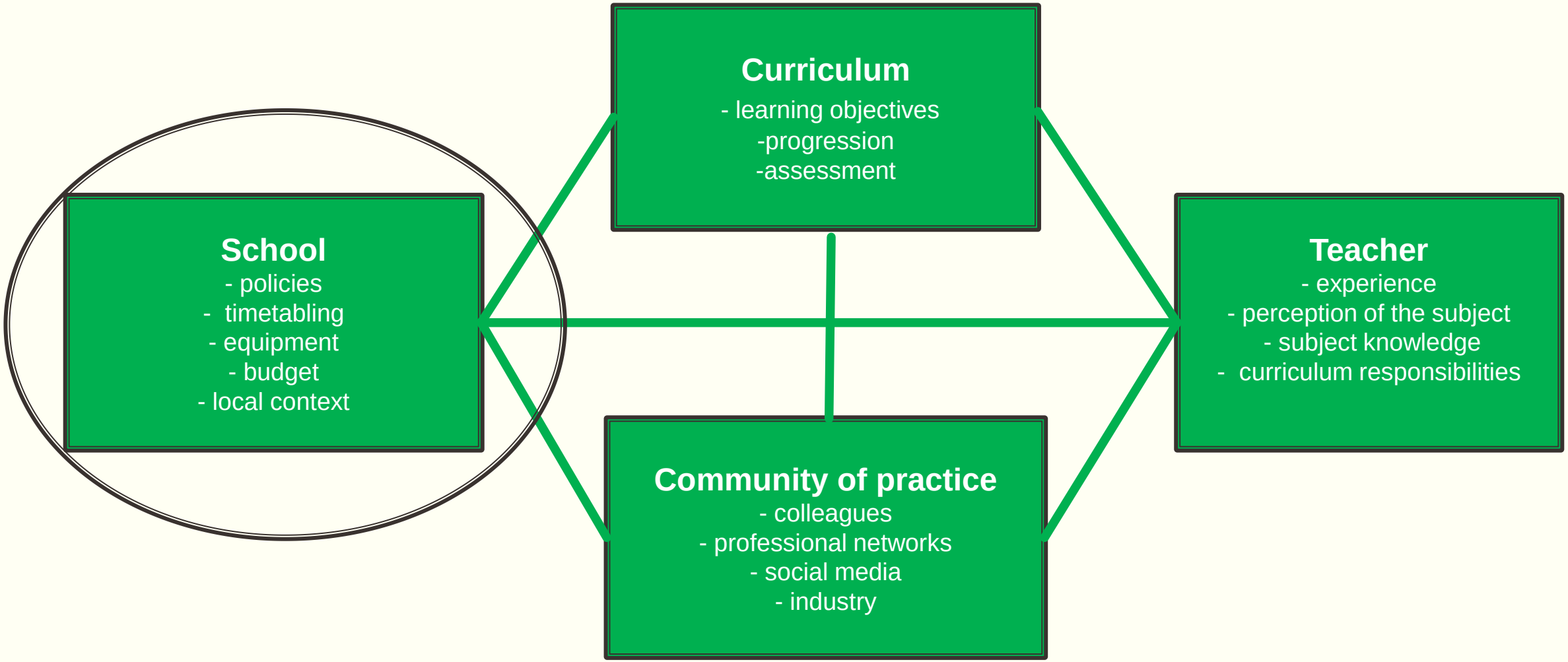
Methodology and data collection

Asked about teachers 2018/2019 plans and schemes of work

Collected via an online survey distributed in November 2018 using forums and social media

Opportunistic sample (n=54) of teachers who participated in three online communities

Results


Curriculum
- learning objectives
-progression
-assessment
School
- policies
- timetabling
- equipment
- budget
- local context
Teacher
- experience
- perception of the subject
- subject knowledge
- curriculum responsibilities
Community of practice
- colleagues
- professional networks
- social media
- industry

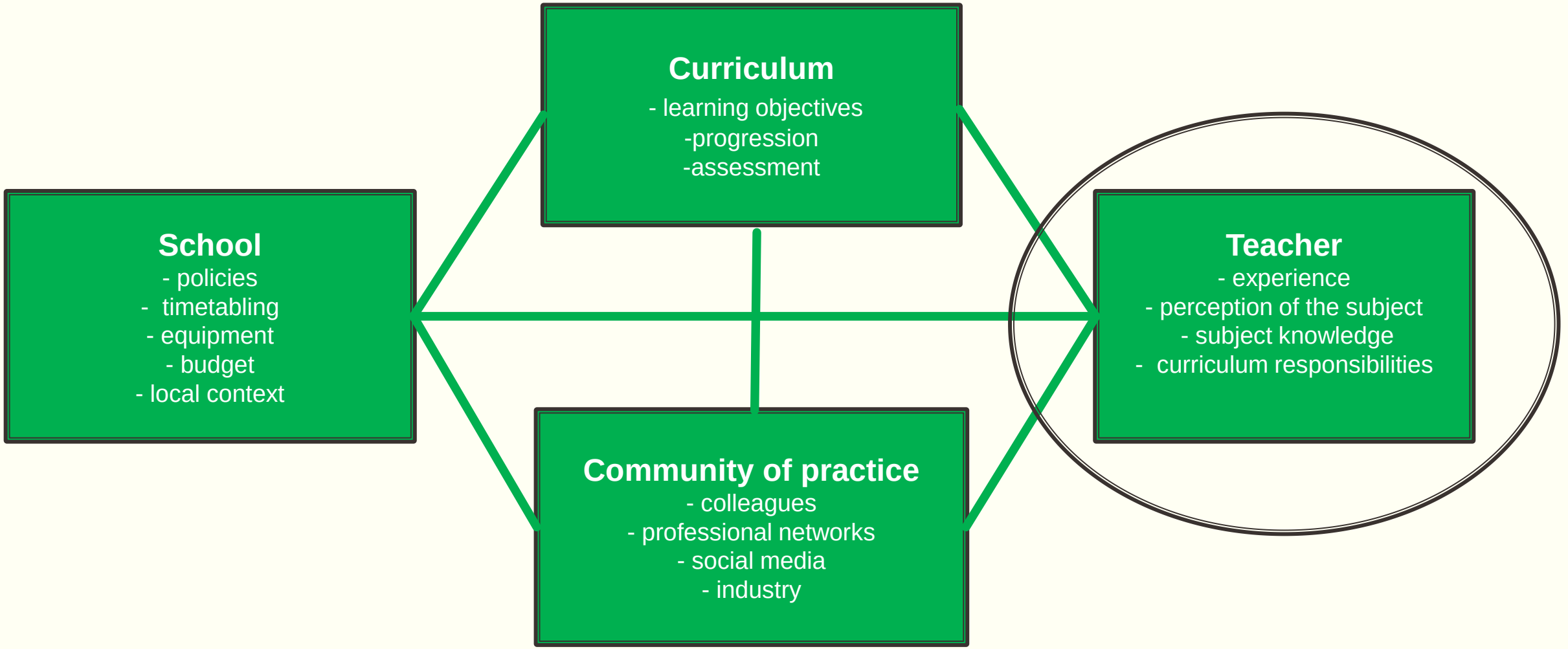
Results

School
- policies
- timetabling
- equipment
- budget
- local context

50% of teachers felt there was **not enough time** to set up for lessons using physical computing devices

61% of teachers wanted to use physical computing devices but **did not have access to enough equipment**

Results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Results

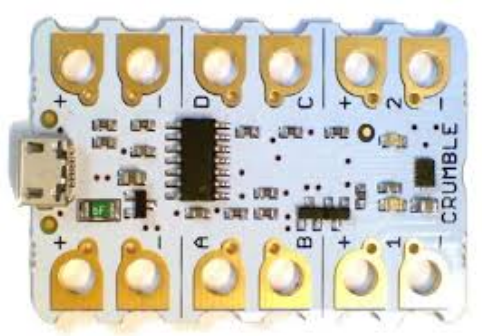
74% of teachers felt they had a good understanding of **the learning outcomes** that can be delivered

98% of teachers felt that using physical computing devices would **benefit** their pupils

Teacher
- experience
- perception of the subject
- subject knowledge
- curriculum responsibilities

What devices are teachers using?

35% of teachers planned to use the BBC micro:bit



31% of teachers planned to use the Crumble

Other prevalent devices included:

Lego WeDo 2.0

Raspberry Pi

Sphero SPRK+

Recommendations

Teachers need access to high-quality resources and training to teach computing using physical computing devices

A non-commercial document is needed for teachers present to senior leadership with the items required, the costs, links to learning outcomes and links to high-quality resources

Further qualitative research is needed to produce case studies which evidence learning outcomes and which investigate practical solutions to the time problems faced by teachers

References

Childs, K., 2017. *Engaging learners in computer science topics: Digital making in the Key Stage 2 classroom* [unpublished]. Work submitted for Nottingham Trent University PDEP43578 Engaging learners in CST

Ofsted and Spielman, A., 2018. *HMCI commentary: curriculum and new education inspection framework* [online]. Gov.uk: Government Digital Service. Available at: https://www.gov.uk/government/speeches/hmci-commentary-curriculum-and-the-new-education-inspection-framework [Accessed 4/12/2018]

Przybylla, M. and Romeike, R., 2018. Empowering learners with tools in CS education: Physical computing in secondary schools. *it-Information Technology* [online]. 60 (2), pp 91-101. Available at: DOI**:** https://doi.org/10.1515/itit-2017-0032 [Accessed 31/10/2018].

Royal Society, 2017. *After the reboot : Computing education in UK schools*. London: The Royal Society. Available at: https://royalsociety.org/~/media/events/2018/11/computing-education-1-year-on/after-the-reboot-report.pdf [Accessed 4/5/2018]

Sentance, S., Waite, J., Hodges, S., MacLeod, E. and Yeomans, L., 2017 [i]. Creating Cool Stuff: Pupils' Experience of the BBC micro: bit. In *Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education* [online]. Pp 531-536. ACM. Available at DOI: 10.1145/3017680.3017749 [Accessed 27/9/2018]

STEM Learning, 2018. *A world-leading computing education for every young person* [online]. York: STEM Learning Ltd. Available at: https://www.stem.org.uk/news-and-views/news/world-leading-computing-education-every-young-person [Accessed 4/12/2018]

Waite, J., 2017. *Pedagogy in teaching Computer Science in schools: A Literature Review* [online]. London: The Royal Society. Available at: https://royalsociety.org/~/media/policy/projects/computing-education/literature-review-pedagogy-in-teaching.pdf [Accessed 9/4/2018].

Questions?

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