



Mapping the use of physical computing at Key Stage 2 (ages 7 – 11) in England



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Background

- Computing was introduced to the English National Curriculum in 2014 to replace the disaggregated subject of ICT
- At Key Stage 2 (ages 7 – 11), pupils are required to design and write programs including those to control or simulate physical systems (DfE, 2013)
- A framework of four key areas was created containing factors which influence lesson planning to explore whether teachers include physical computing to deliver this curriculum area (Fig 1)
- A taxonomy of the different digital devices available was created to explore which ones were being used by teachers (Fig 2)

Method

- Three online communities were selected for their potential to reach suitable Key Stage 2 teachers in England: Computing at School, Primary Rocks and TES
- In line with BERA (2018) guidelines, a gatekeeper for each community was approached to gain consent
- An electronic survey was created consisting of three sections:
 - Demographic information about the teacher and their school
 - A Likert-style series of statements based on the four key areas of curriculum planning influence
 - Labelled pictures of digital devices split into the three tiers
- The survey was distributed via online forums and social media belonging to the three communities and was completed by an opportunistic sample of teachers.
- Data validation took place to remove responses that did not meet the demographic requirements to leave a final, validated sample of 54 teachers.

Figure 1: Key influences on lesson planning

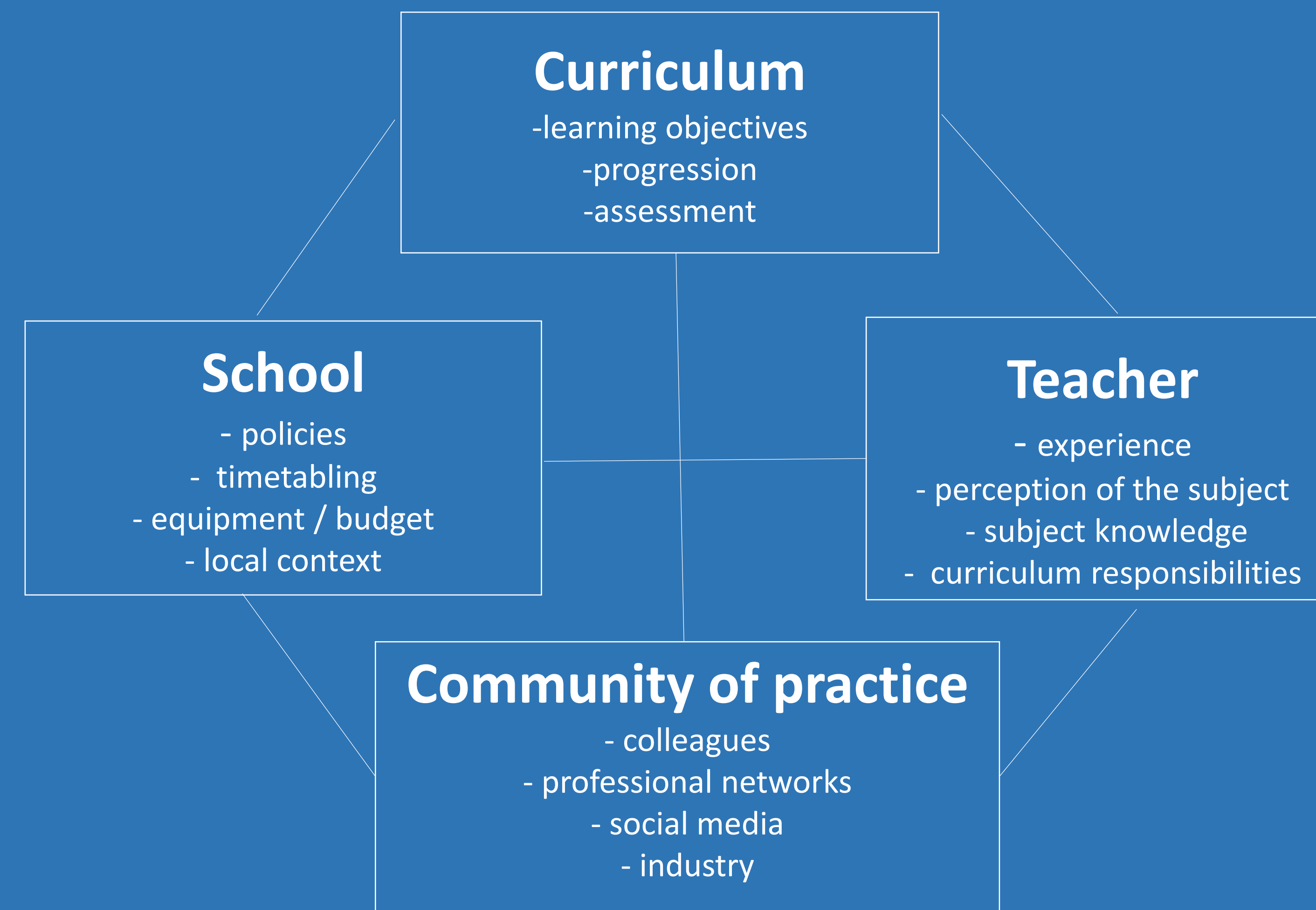


Figure 2: Taxonomy of digital devices for physical computing in Key Stage 2

	Tier 1	Tier 2	Tier 3
Description	Pre-built programmable robot toys	Construction Kits	Circuit boards, microcontroller boards and microprocessor boards
Examples	Dash TTS InO-Bot Sphero SPRK+ Ozobot Edison robots	LEGO WeDo LEGO Mindstorms EV3 Little Bits Flowol + Control Models Ohbot SAM Labs kit	Makey Makey Codebug BBC micro:bit Crumble Raspberry Pi Raspberry Pi Zero

References

British Educational Research Association, 2018. *BERA Ethical Guidelines for Educational Research*. 4th ed. London: British Education Research Association. Available at: <https://www.bera.ac.uk/researchers-resources/publications/ethical-guidelines-for-educational-research-2018>

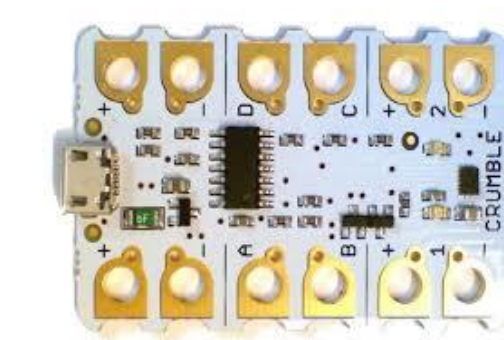
Great Britain. Department for Education (DfE), 2013. *Computing programmes of study: key stages 1 and 2* [online]. London: House of Commons. Available at: <https://www.gov.uk/government/publications/national-curriculum-in-england-computing-programmes-of-study/national-curriculum-in-england-computing-programmes-of-study#key-stage-2>

Findings

1. Microcontroller boards are most prevalent in lesson planning for teachers who have access to equipment. This tier of device offers low-cost, flexible access to physical computing, but can be more time-consuming to set up and use than devices in other tiers.



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



31% of teachers planned to use the Crumble

- Teachers felt the biggest barriers to including physical computing activities were caused by school-level factors (Fig 1)
 - 50% of teachers (n=54) felt they did not have enough time prepare and set up for lessons using physical computing devices
 - 61% of teachers (n=54) did not have access to enough equipment
- Teachers who have the role of Computing Coordinator (71%, n= 31) were almost twice as likely to include physical computing in their plans compared with teachers who did not have this role (39%, n =23).
- The data shows a tendency towards an inequity in access to physical computing equipment based on the size of the school
 - I have access to enough equipment to include physical computing activities in my lessons
 - 11% of teachers (n=9) in small schools of 0-149 pupils agreed
 - 47% of teachers (n=15) in medium schools 150-299 pupils agreed
 - 41% of teachers (n=29) in large schools 300+ pupils agreed

Conclusions

- Training courses and schemes of work which include the use of the BBC micro:bit and/or Crumble would also benefit by the inclusion of non-commercial procurement information and evidence on the impact on learning to share with senior leaders.
- Further qualitative research is needed to produce practical case studies which evidence learning outcomes when using physical computing and which investigate practical solutions to the time taken to set up and purposefully use devices in the classroom.
- There is potential to explore further whether an inequity of access to physical computing equipment exists linked to the size of primary school.