The International Impact of COVID-19 and "Emergency Remote Teaching" on Computer Science Education Practitioners

Tom Crick[1], Cathryn Knight[1], Richard Watermeyer[2], Janet Goodall[1]
Swansea University[1] and University of Bristol[2]
thomas.crick@swansea.ac.uk

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Swansea University
Prifysgol Abertawe

Overarching Research Questions

- *How did the perceptions of the rapid move to online learning, teaching and assessment (LT&A) differ between CS practitioners and other disciplines?*
- *How did the perceptions of the rapid move to online LT&A differ by CS practitioner setting?*
- *What are the key opportunities and challenges resulting from the COVID-19 global pandemic as perceived by CS practitioners?*

Target Population

- Those who have been actively involved in the delivery of LT&A across education globally;
- In order to identify CS practitioners:
  - HE respondents were asked to select their primary discipline against UK JACS codes;
  - Schools/colleges (K-12) were asked if they taught a particular subject;
  - Some recoding of responses to include common cognate areas (e.g. “ICT”, “informatics”, “software engineering”)
- Convenience sampling due to nature of survey dissemination (and ongoing pandemic).

Sample Size

- **N=2,483** members of the international education workforce responded to the survey;
- This included **n=1,465** respondents from the HE sector (59%) and **n=1019** respondents from schools (41%);
- **n=327** respondents indicated that they taught CS (or cognate subjects e.g. ICT). This included **n=196** from the HE sector (59.9%) and **n=131** from schools (40.1%).

Survey

- Anonymous survey was launched internationally on 26 March 2020 and remained open for four weeks;
- Likert scale questions explored respondents' views of the changes;
- In addition, respondents were asked three open-ended questions: "*Please provide any comments of how the online learning and teaching changes brought in as a response to COVID-19 will impact upon...*" followed by:
  - "*...your role*";
  - "*...your institution*"; and
  - "*...your sector of education*".

Quantitative Results

- Those who work within the **CS discipline were significantly more likely** to say that they...
  - ...**felt prepared** ($\chi^2(1)$=31.47, p<0.001);
  - ...were **confident** ($\chi^2(1)$=31.44, p<0.001);
  - ...were **supported by their institution** ($\chi^2(1)$=9.91, p=0.002);
  - ...held a **good working knowledge of appropriate technologies** ($\chi^2(1)$= 63.66, p<0.001);
  - had **access to appropriate technologies** ($\chi^2(1)$=23.24, p<0.001);
  - ...were **confident that their students could access online LT&A** ($\chi^2(1)$=22.51, p<0.001);
- Binary regression demonstrated that the **impact of working within the CS discipline remains significant** when controlling for **setting**, **gender**, and **years teaching**;
- It also shows that **those in schools were significantly more likely to agree** with the statements than those in HE.

Pedagogy and Practice

"*This is the beginning of a new era. Things will never be the same again...*" [HE, USA]

- A key theme was how the changes would lead to more recognition of the importance of technology;
- Respondents foresaw long-term benefits for CS as a discipline across education;
- Flexibility and creativity, fostering innovation practices.

"*This is bringing our staff together in some ways because we are all collaborating and sharing ideas. My principal has been great about communicating with us on a daily basis.*" [school, England]

Bridging the Skills Gap

"*As a Computing teacher, most of my resources are already online. However, teaching programming techniques and complex concepts of computer science online is difficult.*" [school, Wales]

- Lacking professional development opportunities in learning design and online pedagogy;
- Longer-term impact on workload and practice;
- Top-down, "one size fits all" approaches.

"*HE will move increasingly to online provision, sadly. Our technologies do not currently allow the creation and manipulation of shared mental representations which is necessary for effective teaching and learning of mathematics and computer science.*" [HE, England]

Infrastructure

"*Delay in critical upgrades to servers and increase in infrastructure. Need to expend further funds to have suitable hardware to loan to staff in these circumstances.*" [school, England]

- Potential positive impact of financial investment in digital infrastructure;
- Also, opportunities for professional development in the area of online LT&A; it was recognised that there had been "*...more ongoing support for staff with technology*" and this would lead to long term benefits.
- Concerns were also raised about equity of access to the necessary resources for learning:

"*Online learning in CS is heavily dependent on pupils' home access...*" [school, USA]

Key Themes

- The COVID-19 context has clearly not gone away, but has shifted;
- Challenges/opportunities presented from "emergency remote teaching" and rapid shift to online LT&A could be applied more broadly across educational settings, internationally;
- Fragility, precarity, workload, jobs, career progression (ECRs, diversity), financial sustainability (HE);
- Impact on prominence/perceptions of the emerging discipline of CS (schools); cf. CS vs. "digital skills"?
- Key focus on appropriate pedagogic/assessment approaches for CS;
- Wider policy context: post-COVID economic recovery, increased focus on "digital", future skills demands.
- **Q:** why were schools generally more prepared/confident than HE?
- **Q:** how best to follow-up with this work going forward?

Related Work

Read all published papers from this work: including invited blog posts (e.g. Nature), related surveys, as well as COVID-19 government consultation submissions:

`https://proftomcrick.com/tag/covid-19/`

Swansea University
Prifysgol Abertawe

Diolch/Thanks!

Professor Tom Crick
@ProfTomCrick
thomas.crick@swansea.ac.uk

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