COMPUTING AT SCHOOL
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Report of the CAS Assessment working group
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Context and purpose of this report

Computing (including computer science and computational thinking) was introduced as a school subject in September 2014. Assessment in computing is therefore at the beginning of development.

Assessment has enormously powerful effects. Good assessment drives teaching and learning by focusing attention on what is important. Poor assessment can be actively harmful, by measuring the wrong things, or by being unduly onerous. Assessment in computing is particularly challenging in the areas of computational thinking, creativity and the teaching of computer programming.

This report briefly reviews the current situation of assessment in computing and makes recommendations for what should be done to improve it.

The purpose of assessment

The purpose and nature of assessment in computing is to identify a learner's existing knowledge, beliefs and motivation and to inform the learner, the computing teacher, parents, and the school with regard to learning, teaching and reporting.

Learning:
- it informs learning (what has been attained, what progress has taken place and the next steps in the learning journey);
- it informs learners (through peer-assessment and self-assessment giving a sense of ownership and individualisation in learning);
- it informs cross-curricular progress enabling learners and teachers to build on strengths and areas for development without predetermining future outcomes;

Teaching:
- it informs teaching (the planning, curriculum content and the pedagogy to be adopted);
- it informs teachers (of how to respond to learners, self-evaluate their teaching, provide evidence of performance for appraisal);

Reporting:
- it informs other stakeholders (i.e. parents, school managers) of the progress of learners;
- it provides evidence for external validation and accreditation.

Current state of assessment in computing

The effectiveness of assessment of computing in schools today is limited by a number of difficulties:

- The assessment of knowledge and skills of computing is easier than assessment of understanding and attitudes. The former should not dominate our assessment processes because the computing curriculum content is rich in concepts. It is also important, and challenging, to assess the underpinning ideas of computational thinking and creativity. The need to assess the ability to program is unique in the subject of computing and presents one of the greatest challenges.

- The culture of high stakes summative assessment, secondary school league tables of students' achievement in the English Baccalaureate, Progress 8 or 5 A*-C grades and the focus on English and mathematics in primary schools, has led to the perception that the assessment of other subjects, including computing, has a low priority in many schools.

- The end-of-module, product-based, summative approaches to assessment, in all key stages, have the potential to devalue or distract from the evaluation of the learning process.

- GCSE examinations in Computing have attracted criticisms in terms of their design and implementation, including the onerous nature of evidence gathering. They do not fully address the assessment of computational thinking or creativity. One significant opportunity for demonstrating understanding is the non-examined assessment (NEA), but this may prove challenging to implement.

- The need to remember large quantities of information can be a barrier for learners, particularly some with special educational needs, and can impair their success in formal or summative assessments. These learners are not being given appropriate opportunities to demonstrate what they can do, know or understand. Equally, assessments rarely accommodate the use of twenty-first century skills they have developed to demonstrate their achievements and abilities.

Improving assessment in computing

All stakeholders with an interest in assessment are encouraged to:

Increase support for formative and summative assessment:
- design, develop and deploy digital repositories of learning and assessment opportunities, including activities, questions and answers, with demonstrable ties to the computing curriculum;
- employ technology in developing innovative approaches to assessment;
- develop assessment opportunities for all aspects of computing, including computational thinking, creativity and programming.

Increase learner ownership of learning:
- align classroom learning opportunities to reward systems, such as stamps, stickers, or digital badges as appropriate for the age group, in order to recognise and celebrate learners' achievement and progress;
- promote lifelong learning and a growth mindset allowing learners to develop their strengths and to recognise areas in which they are "not yet" competent, by effective use of assessment for learning (AfL);

Recognise higher order skills and understanding:
- make computational thinking and creative opportunities more explicit to teachers and learners in order to promote development of higher order thinking skills and to inform planning, learning and assessment;
- promote acquisition of computational thinking skills through problem solving questions across all key stages

Our recommendations

These recommendations arise from the discussions around assessment of computing and are focussed upon the various stakeholders including Ofqual, awarding organisations, school managers, curriculum managers, subject associations, researchers and academics, and teacher trainers.

Ofqual

Having oversight of qualifications affords Ofqual the opportunity to influence the direction of assessments. Ofqual is encouraged to:

- require assessment of computational thinking to be made explicit as appropriate to the different subjects in information technology and computer science qualification specifications;
- require good practice in assessment design, such as questions created for problem solving that incorporate computational thinking and creativity.

Awarding organisations

As designers of assessment, the awarding organisations are uniquely situated to influence assessment. Awarding organisations are encouraged to:

- recognise that e-assessment has opportunities and limitations and use it only where appropriate to support learners and inclusive assessment;
- develop and validate new models for assessing programming, including, but not limited to, online and non-examined assessment alternatives;
- state the connections between the assessment objectives in the specifications and the endorsed resources;
- create and make accessible to teachers online repositories for questions, answers and rationales.

School managers

With expertise in implementing procedures in the day-to-day function of educational institutions, school managers have a key role in influencing assessment. School managers are encouraged to:

- recognise that in key stages 1 and 2 it is appropriate to teach and assess parts of the computing curriculum with a cross-curricular approach but in key stage 3 the subject should be taught and assessed by specialist teachers in computing lessons;
- support informal assessment opportunities that contribute to formal summative assessments, in line with the Commission on Assessment without Levels guidance;
- adopt or develop assessments which recognise computing competencies that can inform transition across key stages and starting points in modules of work;
- recognise where learning will be improved through the assessment of process rather than the outcome of units of work and provide time for teachers to give effective and frequent formative feedback.

Curriculum managers

With their knowledge of classroom practices, curriculum managers are well-positioned to promote effective assessment. Curriculum managers are encouraged to:

- identify explicitly the opportunities for computational thinking and creativity within the planning and assessment of learning;
- increase the assessment literacy of colleagues through professional dialogue and CPD, including an increased awareness of repositories, frameworks, guidelines, badges and resources;
- support the assessment literacy of learners and their ownership of learning (AfL) by the use of self and peer assessment.

Subject associations

With their view across different areas of the curriculum, the subject associations are in a position to promote best practice in assessment. Subject associations are encouraged to:

- support CPD that addresses the issues of assessment;
- support a community of practice around assessment;
- engage with other subject associations to promote awareness of computational thinking and its assessment across the curriculum.

Researchers and academics

With their knowledge and experience of research in the field, researchers and academics are well-positioned to inform our understanding of the assessment of learning, attainment and progress in the teaching of computing. Researchers and academics are encouraged to investigate:

- the practicality of using closed, online environments for the teaching and assessment of programming, incorporating the use of feedback-based adaptive assessments;
- the nature of computational thinking and the possibility of establishing a taxonomy of computational thinking skills;
- the relationship between thinking skills, computational thinking and programming aptitude and the implications for learning, teaching, and assessing in computing;
- the affordances of repositories of assessments and the nature of good question design.

Teacher educators

Having responsibility for educating teachers of the future affords the opportunity to promote the effective use of assessment in the classroom. Initial teacher educators are encouraged to:

- ensure that student teachers are equipped to identify appropriate assessment opportunities across the whole of the computing curriculum, including computational thinking and creativity;
- ensure that student teachers develop a critical perspective on the use of assessment tools and techniques in computing;
- ensure that student teachers are aware of the range of tools for assessing learning, attainment and progress in computing;
- ensure that student teachers are proficient in using pedagogic techniques appropriate for the computing classroom, including promoting resilience, perseverance and independence.

CAS Assessment working group members

The CAS Assessment working group is made up of volunteer CAS members from a range of educational backgrounds including teachers, subject leaders, teacher educators, examiners and advisors; all have a common interest of promoting the teaching of computing. This report arises from a series of workshops and online discussions.

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