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The effects of Covid-19 on student transition from school to university in STEM subjects

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Abstract

Covid-19 restrictions affected most of the post-16 learning experience of the students who will begin university courses in STEM in the UK in autumn 2021. Ongoing disruption to learning culminated in the cancellation of normal A-level examinations which were replaced with teacher assessments. Informal discussion with secondary school teaching colleagues reveals some possible consequences for the students' transition to degree level study in STEM subjects. The main suggestion is that, despite the resilience that students have shown both academically and socially, there have been significant omissions from the normally studied curriculum that may affect their progress on degree courses in STEM including: lack of experimental practice and skills, lack of specific subject knowledge and lack of experience of assessment.

Introduction

Even in normal circumstances the transition from school to university study has long been known to be stressful for students (Fisher & Hood, 1987). A useful definition of this transition is found by Gale and Parker (2014) to be "*the capability to navigate change*". One of these changes for many students in STEM fields, and especially in engineering, is highlighted by Andrews, Clark and Knowles (2019) as students' ability to cope with increased expectations of mathematical knowledge. There are related, ensuing demands on problem solving and applications of mathematical knowledge to new contexts. Another change highlighted by Smith (2012) is in students' laboratory skills which are limited, even at the best of times, to using narrowly focussed "recipe-style" techniques in school. Students are quickly expected to adapt to being more independent in problem-based laboratory tasks. There is also considerable change in the modes and expectations of assessment between school and university such as the frequency and amount of personal support that may be offered by teachers. As well as identifying this, Skinner (2014) calls for university teachers to know more about their students' prior educational experiences – particularly in shaping students' understanding and expectations of assessment.

These and other changes for students have been exacerbated by the covid-19 pandemic in three main ways. Firstly, students have experienced periods of lockdown or self-isolation away from the normal educational environment of the school or college. Secondly there has been a resulting and variously implemented move to online modes of learning. Thirdly there have been resultant changes to A-level assessment (Department of Education, 2021) which removed external examinations on the full specified A-level curriculum and allowed schools to assess their students in different ways on a narrower range of content and to exclude practical skills assessments. This article explores the effects of covid-19 on the transition of students from

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school to university in STEM in these (and other areas) from the perspective of teachers in state schools.

Methods

Four teachers of post-16 science in different state schools in the locality of a research-intensive university in the midlands of England were interviewed informally. At the end of the summer term of 2021 after all A-level assessment had finished, they were asked by email to comment generally on their views of the effects of the covid-19 lockdown and assessment changes on their students' knowledge, skills and transition to university study. This email was followed up by a face-to-face or video call conversation lasting approximately 30 minutes allowing the teachers to explain their views as fully as they could.

Findings

All four teachers were very keen to highlight some positives arising from the covid-19 experience. These were:

- Praise for the resilience of the students they had taught and an emphasis that despite spending significant amounts of time out of normal lessons over the past 18 months they all felt sure that most students had been able to recover lost ground academically.

- Increased independent learning skills for some students. Some students had clearly thrived on the freedom of working from home for significant lengths of time. There is an important caveat to this however – all of the teachers could think of individual students who had not engaged with learning during these periods and found it difficult to work without the personalised support that would normally have been provided by the school.

After this positive start to all the discussions however, the teachers spent significant time articulating areas where they felt that students' experiences had been different to students in a 'normal' year. Combining the comments from the four teachers these areas are:

- Lack of curriculum knowledge. Most students in the schools where the teachers worked had not been taught the whole A-level curriculum in any subject – only that required for in-school assessments.

- Lack of experimental skills. Most students had started to undertake some science laboratory work in school before the first lockdown in March 2020 but then did no further practical work for the remainders of their A-level courses.

- Lack of normal classroom learning experiences. The majority of the teaching the students received was online. The extent to which there had been a return to in-person lessons was variable in the schools and the variety of learning tasks was very limited as necessitated by social distancing. For example none of the schools represented had done any group work, peer supported problem solving or used student presentations.

- Lack of assessment and feedback. The normal rhythm of regular classroom-based assessment and feedback and then formal examinations at the end of the course had been disrupted for all the students.

- Lack of a revision period. None of the schools run formal end of A level assessments in the normal way so the long period of consolidation of knowledge that revision represents was also absent. One teacher described this as a tangible sense of 'rustiness' in the knowledge of students compared to a normal year.

- Lower expectations of academic work. Many students had experienced reduced workloads during the periods of home school and had struggled to cope with the return to the volume and rigour of formal, in-person education. Schools had experienced more than normal problems with students having organisational difficulties (e.g. ability to meet deadlines).

- Social and psychological difficulties. Despite the resilience shown by most students, all of the teachers could identify individual students for whom the covid-19 experience had led to increased feelings of anxiety and stress. Students were sometimes not able to distinguish between acceptable and problematic levels of these feelings – for example in the run up to in-school assessments. A general feeling of student having had a 'rubbish year' was also reported and of students feeling an understandable sense of disappointment at having been deprived of 'rite of passage' events.

Implications

Firstly, in this discussion I am assuming that none of the 'lacks' identified above are in any way the responsibility of the student – they are the outcome of circumstances beyond their control. As such, students who often find transition from school to university stressful face additional pressures that could be made worse if universities are not mindful of these issues and ready to act in response. The findings above may therefore pose institutional challenges to HE providers of STEM education. Some of these are:

The lack of curriculum knowledge caused by the removal of standard A-level assessments has precipitated a situation where different students from different schools may have covered different amounts of curriculum content in key subjects. In the four schools in this study there was no agreement in areas covered by students in mathematics, physics or chemistry. Schools were able to exercise autonomy over the subject content they assessed. Based on this informal data I would suggest boundary conditions for subject content exist. In the worst case, students have only been assessed on year 12 (first year post-16) taught content, and, in the best case, students have covered the whole A-level curriculum content fully. There is therefore significant inequality – and students themselves are very aware of this. Perhaps the area in which this may be most keenly perceived for STEM subjects will be in the range and confidence of mathematical skills that new students are able to demonstrate.

In terms of experimental skills, whilst it is often acknowledged that STEM courses must have extensive inductions to acclimatise new students to the advanced environment of the university laboratory, this year there will be the additional challenge of students who may need instruction in making basic measurements using simple apparatus. There may be training needs for laboratory demonstrators, not necessarily in the technical requirements of the experiments but in terms of how to adapt teaching to students with a much broader range of learning needs in this area than is normally experienced.

The lack of assessment in the past 18 months also has a number of potential consequences. Not having the consolidation period of revision may not only impact student subject knowledge in the short term but also impair study skills in the longer term and reduce students' confidence in their own knowledge. These things may interfere with the process of students gaining a self-identity as a student of their specialist subject quickly in year 1 of their course. A lack of ongoing formative feedback may also lead to students having unrealistic and inaccurate self-estimations of their own knowledge – either positively or negatively which have their own results. In addition there is simply a lack of experience for many students of taking part in formal, closed-book examinations – important because these are still an expectation of many university assessment processes in STEM subjects.

Ways Forward

Arising from these discussions of both the short- and longer-term effects of covid-19 on student transition to university in STEM subjects are some suggested areas for further discussion and development. These are presented as discussion questions:

- How can support be provided to new students in addressing gaps in their subject knowledge without implications of blame or responsibility attached?

- How can prior knowledge starting points for year 1 courses be re-considered in the light of the covid-19 circumstances?

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- What opportunities are there for students to accurately assess their own knowledge and skills near the start of STEM courses?

- To what extent are different types of assessment explained to students and also practiced before being used?

- How often are messages and re-assurances about academic and well-being support given to students?

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