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Motivating and engaging learners

Introduction

Engagement and motivation are closely connected in many studies but this is an area of social sciences research where such concepts are viewed from several different perspectives without any clear agreement about their meaning or the nature of interactions between them. Engagement is often viewed as an involvement or participation in learning involving behaviour, emotions and cognitive elements, which may be triggered by motivating factors. Motivation may be considered to be an inclination or disposition towards a certain behaviour (Hannula 2006), which is based on an individual's reasons and beliefs but also affected by emotions. These broad descriptions will be adopted in this paper to allow sufficient space for discussion of their application in FE rather than full details of theoretical debates.

The engagement of students with mathematics is a primary concern for FE colleges, particularly for lower-attaining 16-18 year old students taking GCSE or functional skills mathematics as part of their study programme. The issues have become more significant since the introduction of the condition of funding in 2014/15, which requires students without GCSE Mathematics Grade 4 or higher (previously Grade C) to continue studying mathematics until they reach this standard. This has resulted in large increases in the number of students studying mathematics at Level 2 or below in FE colleges. In addition, the amendment to the condition of funding in 2015/16, requiring students with a prior attainment of Grade 3 (previously Grade D) to re-sit GCSE rather than taking an alternative qualification, has shifted the balance of mathematics provision further towards GCSE re-sits.

The qualification that an individual student will follow is determined by a combination of government policy and college-level strategies. These are aimed at improving achievement rates for mathematics and/or measures of student progress[1] but the impact is that 16-18 year old students have few opportunities to exercise any choice about whether they study mathematics or not, or what qualification they do study.

Under these conditions, students are studying mathematics regardless of whether they have any motivation to do so or have any interest in the subject. Prior experiences of learning mathematics, which have resulted in low attainment often lead to perceptions of 'failure', which can lead to negative attitudes, de-motivation and a reluctance to re-engage with mathematics learning in FE colleges (Higton et al. 2017, The Research Base 2014). A low level of engagement with mathematics may be evidenced by poor attendance at mathematics lessons, or avoidance behaviours (even when present in lessons) and a lack of effort to learn mathematics (Dalby 2014). Ultimately these behaviours have a negative impact on the progress a student makes with the subject.

Levels of motivation and engagement are variable amongst a student cohort, since individuals have different prior experiences of mathematics and reasons to engage (or not) with mathematics learning. Some of the causes of disengagement are shared by school leavers and mature adults returning to learning, since these arise from similar negative prior experiences. However for adults, the subject is not compulsory and many adults return to

[1] Interim findings from the Mathematics in Further Education Colleges (MiFEC) project, unpublished at the time of writing. The project is due to report in the autumn of 2019.

learning mathematics in pursuit of clear personal goals such as progression to Higher Education or self-improvement which provide strong motivation. Although some 16-18 year old students have similar goals of progressing to further study, for which GCSE mathematics is a 'gate-keeping' qualification, motivation levels amongst this age group are often lower[2].

Background

A number of recent studies (see below) have highlighted the issue of poor engagement with mathematics amongst low-attaining students in post-16 education and a low level of motivation to continue studying the subject. These reports shed light on the issues but do not provide very extensive evidence of successful strategies to overcome these problems. In summary, poor engagement and motivation may arise from:

- Negative prior experiences of learning mathematics (The Research Base 2014)
- A lack of confidence with mathematics (The Research Base 2014)
- Anxiety about mathematics or about taking a mathematics examination (Higton et al. 2017)
- Exposure to negative cultural attitudes to mathematics in society (Smith 2017)
- Peer pressure (The Research Base 2014)

Social influences and personal experiences are key areas where negativity needs replacing with more positive perceptions or experiences of mathematics. There is a need to change mind-sets so that students develop confidence and are prepared to re-engage with mathematics (The Research Base 2014). FE teachers therefore face the challenging task of changing students' beliefs about mathematics and dealing with low self-esteem as well as teaching mathematics. This demands a classroom approach that is not simply about cognitive development but also addresses negative attitudes and emotional responses to learning mathematics.

Supporting students to overcome these barriers to learning mathematics may require a range of strategies to improve engagement (Higton et al. 2017, Robey and Jones 2015). The reasons for disengagement are diverse, so approaches to re-engagement also need to be varied to adequately address students' needs (The Research Base 2014). Teachers will need more than one strategy but these need to be implemented in a safe, organised environment for students where they experience being part of a community (The Research Base 2014). Within this environment, there is value in learning mathematics in a way that is enjoyable and interactive, or has some direct relevance (Robey and Jones 2015) (c.f. Contextualisation briefing) which is linked to personal goals or interests (Dalby, 2014). The value of effective, timely assessment (The Research Base 2014) and feedback is also highlighted so that students are aware of their progress (The Research Base 2014, Robey and Jones 2015) (c.f. Technology and Data briefing).

A review of the 'most promising' mathematics interventions that might improve mathematics outcomes for low-attaining post-16 students (Maughan et al. 2016) does not include interventions that specifically address engagement and motivation, although there is some reference to the use of volunteers (Karsenty 2010) to support low-attaining students. The main principles underpinning this particular volunteer intervention focus on opportunities for individualised learning at an appropriate pace and for emotional support in a comfortable environment where frequent personal encouragement helps build confidence and self-

[2] Mathematics in Further Education Colleges (MiFEC) project interim findings

efficacy. Although untested in the context of FE colleges, the underlying principles do resonate with reported issues and are worth noting.

Issues

In order to design effective interventions, the problems of poor motivation and engagement amongst low-attaining post-16 students need to be better understood. In this section some relevant theoretical views and international research studies will first be considered and then used to frame a discussion of the main issues and possible interventions.

A range of theories have been used that aim to deepen understanding of the motivations that affect student behaviour. These include self-determination theory (Ryan and Deci 2000b), achievement-goal theory (Ames 1992, Dweck 2000), expectancy-value theory (Wigfield and Eccles 2000) and flow theory (Shernoff et al. 2014).

It is generally agreed that motivation is affected by multiple factors of both internal and external origin. A distinction between intrinsic and extrinsic motivation has been made for some time (Brophy 2013, Ryan and Deci 2000a) which highlights the differences between motivation due to the actual activity being undertaken (i.e. learning mathematics) and motivation that is stimulated by its contribution to another external goal. For example, extrinsic motivation is evidenced amongst GCSE re-sit students when a student needs the qualification for personal progression to further study (e.g. university). Intrinsic value is found when the student can identify direct relevance and becomes interested in the actual mathematics. Other studies have referred to the related constructs of exchange value and use value of mathematics (e.g. Williams 2012). Further studies suggest a more refined view with a distinction between autonomous motivation, which involves an individual identifying with the value of an activity, compared to controlled motivation where there is some external regulation (Deci and Ryan 2008).

Individual goals can provide reasons for motivation but the development of learning goals rather than performance goals can make an important difference since these encourage students to persist in attempts to understand a subject (Grant and Dweck 2003). Social-contextual conditions can also affect levels of self-motivation since these can provide the conditions for basic psychological needs to be satisfied such as competence, autonomy and relatedness (Ryan and Deci, 2000a). Motivation is however not an observable or measurable construct (Hannula 2006) but may be apparent when manifest in student behaviour. The effect of motivation on student behaviour is therefore an important connection to be made since this leads to observable effects such as engagement behaviours.

Both motivation and engagement are often considered in conjunction with concepts such as attitudes, emotions and beliefs (McLeod 1992). McLeod's (1992) conceptualisations and framework have been fundamental to studies in this area, linking beliefs, attitudes and emotions into a single dimension ranging from stable traits to transient states. These concepts, with the addition of values (DeBellis and Goldin 2006) are widely accepted as fundamental to studies of this area (often referred to as 'affect') in mathematics education. Further studies draw on findings from different disciplines, such as psychology and neuroscience but emotions emerge from these studies as one of the most important concepts to consider (Zan et al. 2006) from several different perspectives (Evans and Zan 2006, Damasio 1998).

Amongst emotional responses to mathematics, anxiety has long been recognised as a problem affecting learning and has been the focus of multiple studies since early identification of the issues (Buxton 1981, Dew, Galassi, and Galassi 1984). These studies include research

into specific situations such as an examination of the emotions during mathematics problem solving activity (Pajares and Miller 1994). Other aspects that appear frequently include confidence (Burton 2004) and self-efficacy[3] (Pajares and Graham 1999, Usher and Pajares 2008). These affect an individual student's motivation to learn and their engagement with mathematics. Scales of measurement have been developed and used for constructs such as anxiety and self-efficacy but robust research evidence is difficult to find pertaining to the pedagogical approaches that have a positive impact on student motivation and engagement, particularly in the context of low-attaining post-16 students.

Recent evidence from the MiFEC[4] project indicates that student engagement with post-16 mathematics needs to be stimulated on three levels:

1. Attendance at mathematics lessons;
2. Engagement with classroom activity;
3. Engagement with the mathematics.

The first of these primarily involves work by teachers, managers and support staff outside the classroom. Most colleges have localised strategies and systems in place to address student attendance[5] (Higton et al. 2017) since this is a major issue crucial to meeting the condition of funding. These include college-wide monitoring and reporting systems, supporting processes and multiple stages of intervention to encourage re-engagement[6].

Engagement with classroom activity and with the actual mathematics focus more on classroom-based approaches for students who are attending lessons, although appropriate teaching approaches are also one of the factors that can encourage better attendance patterns. Such teaching approaches form the main focus of the remainder of this section and are now discussed in relation to the stimulation of positive attitudes and emotions that may lead to better engagement.

Negative emotional responses to mathematics are often the triggers for behaviour to disengage from mathematics. The framework developed by Hannula (2002) helps differentiate between responses to different aspects of learning mathematics:

1. Emotions stimulated whilst learning mathematics
2. Emotions associated with the subject
3. Expected consequences of the activity
4. Relation to personal values.

One approach to developing better engagement is therefore to deal with each of these aspects and to develop positive emotional stimuli. Some possibilities appropriate to the engagement of low-attaining students in the FE context are summarised below.

1. Emotions stimulated whilst learning mathematics

- The learning environment is an important part of learning mathematics. The mathematics classroom needs to be a welcoming, inclusive and 'safe' place where students are unashamed to make mistakes, peers are supportive and there is a collaborative sense of being part of a community on a shared learning journey (The Research Base 2014, Robey and Jones 2015).

[3] Self-efficacy is the confidence or personal belief in one's ability to perform a task successfully, such as solving a mathematics problem.

[4] Mathematics in Further Education Colleges (MiFEC) project interim findings.

[5] ibid

[6] ibid

- A positive teacher-student relationship is an important part of a classroom culture that encourages students to engage (Higton et al. 2017; Dalby 2014).
- Classroom activities that are interesting (i.e. related to students' interests and preferences) and actively involve students can stimulate positive emotions (Robey and Jones 2015).

2. Emotions associated with the subject of mathematics

- Students need to see the subject as one that is different from the negative image of mathematics that they have built up. When students are consistently subjected to positive images of mathematics in the college culture, and experience mathematics in a different way, they are more likely to develop more positive responses (Higton et al. 2017; Dalby 2014).
- Specific negative emotional responses to the subject such as fear or anxiety can be addressed by appropriate reinforcement of positive experiences, including techniques based on the development of growth mind-set (Boaler 2013, Dweck 2000, 2008).
- Demonstration of practical or personal relevance of the mathematics being learned often evokes more positive responses from students (Robey and Jones 2015; Higton et al. 2017; Dalby and Noyes, 2016) .

3. Expected consequences of the activity

- Students respond positively when they feel they are actually learning and making progress. Short-term goals that allow students to evidence progress can therefore lead to more positive emotions (Higton et al. 2017).
- Developing the confidence and self-belief to tackle and overcome difficulties encountered when learning mathematics can help students make progress and reach those goals. This may be facilitated by strategies to develop resilience (Johnston-Wilder and Lee 2010) and to deal with anxiety at points of particular stress such as examinations.

4. Relation to personal values.

- The value of mathematics needs to be seen in relation to students' values. These may be personal values, associated with their age and social situation, or related to their career intentions (Dalby and Noyes 2016).
- Typically, students are more positive when they see the relevance of mathematics to their own education and career pathways, either as a 'gate-keeping' qualification that has 'exchange-value' or as a set of skills that has 'use-value' (Dalby and Noyes 2016).
- Mathematics does not sit easily alongside vocational learning for many students. The values underpinning vocational learning and those in mathematics classrooms need harmonisation (Dalby and Noyes 2015, Dalby and Noyes 2016).

Many of the above points are potentially sources of autonomous motivation that can lead to positive engagement behaviours amongst students. There is also a link to the developing identities of students at this stage of their education. As a result of exposure to learning mathematics students develop identities as learners of mathematics (Askew 2008) that reflect their attitudes, emotions and cognitive achievements with the subject. By providing a different learning situation in FE to that experienced before, students' identities can change (Dalby 2014). Strategies and interventions to improve motivation and engagement might therefore form part of a contrasting learning experience that facilitates the development of more positive identities as learners of mathematics.

Possible interventions

A consideration of the four aspects of learning mathematics summarised above suggests some key areas where appropriate approaches to learning may stimulate positive emotions, provide additional *motivation* and lead to better *engagement* with learning mathematics:

1. Classroom culture; relationships (teacher-student); learning activities that relate to students' interests and encourage active social involvement.
2. Promotion of positive images of mathematics across the whole college curriculum; development of growth mind-set; practical or personal relevance.
3. Setting and reviewing short-term goals; developing resilience; dealing with anxiety.
4. Promotion of the importance of mathematics across the curriculum; learning resources that emphasise the relevance of mathematics; teaching approaches that embrace the dominant pedagogies associated with students' main study programmes;

The following approaches or interventions address either one or more of the above and would seem applicable in the context of low-attaining students in FE colleges studying mathematics:

- Peer mentoring/support from trained volunteers who may be either college students on other study programmes (e.g. A levels) in college or from nearby HE provision. The intervention would take place through regular meetings (virtually or face-to-face) with the aim of providing individual encouragement to engage in out-of-class mathematics learning, direction to appropriate on-line learning materials and personal encouragement.
- Designed lessons with a shared approach to cognitive development but several different adaptations of the lesson that are aligned to the dominant pedagogies on different study programmes and student preferences (e.g. physically active approaches such as carousel activities for Sport; computer-based learning for Media students).
- A short introductory phase to the year in which mathematics teachers focus on assessing and understanding students' emotional needs and challenges before adopting appropriate dialogic approaches within the classroom to address issues identified.
- The integration of regular one-to-one conversations with students into the year plan to set short-term achievable goals and affirm small steps in learning.
- Staff/student training and implementation of strategies to address mathematics anxiety, particularly concerning examinations.
- College-wide training and monitoring of how positive images of mathematics can be presented by all staff.

Summary

Motivating and engaging learners

Motivation and engagement are often considered in conjunction with concepts such as beliefs, attitudes and emotions (such as self-efficacy and anxiety). There is much research and, of course, anecdotal evidence and experience of, GCSE re-sit students having negative responses in all or most of these areas. Our work that addresses this theme should, therefore aim to stimulate positive emotions, provide additional *motivation* and lead to better *engagement* with learning mathematics. This suggests a focus on:

1. The classroom culture that addresses relationships (teacher-student)
2. Learning activities that relate to students' interests
3. Recognising and being sympathetic to students' usual ways of working and study on the main part of their programme by reflecting this in their mathematics lessons (for example, encouraging active social involvement where necessary)

4. Setting appropriate and achievable short-term goals that support a 'growth mind-set'/'can do' attitude and resilience, and monitoring closely progress towards and recognising/rewarding success in achieving these.
5. Promoting positive images and the importance of mathematics across the whole college curriculum.

Our aim will be to develop an approach that fosters improved student motivation and engagement that is structured around these key elements.

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