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Supporting New Academics' Use of Student Centred Strategies in Traditional University Teaching

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Supporting New Academics' Use of Student Centred Strategies in Traditional University Teaching

Abstract

Despite the perceived advantages of student centred learning (SCL) in higher education, novice teaching academics' attempts to implement such approaches may be thwarted by a lack of experience with teaching in general and with SCL in particular, difficulties locating suitable practical advice on SCL, and the demands of early career academic workloads. This article seeks to provide practical assistance to teaching academics seeking to implement SCL into traditional teaching environments. It synthesizes current literature to provide an overview of 3 broad SCL strategies: inquiry learning, concept checks and just-in-time teaching. Key considerations for implementing each of these strategies are identified and the authors discuss four observations about the implementation of SCL, in context.

Keywords

Student Centred Learning, Guided Inquiry Learning, Concept Check, Just-in-Time Teaching, novice academics, academic development

Introduction

The use of student-centred learning (SCL) activities is increasing in tertiary education. This can be attributed to a shift from a focus on the activity of teaching, particularly in the form of teachers' structuring and presentation of knowledge, to the process of learning, with a focus on learners' characteristics, experiences and efforts to make sense of what they encounter in educational settings (Barr & Tagg 1995). The drivers for the implementation of SCL are both pedagogical and practical. As technology evolves rapidly in the 21st century, the body of knowledge in many domains is increasing dramatically. Students require the skills to continually adapt by acquiring new information and learning independent of instruction (Chuxiong 2003). They need to be critical thinkers, problem-solvers and lifelong learners. In addition, they must be adept at communication, teamwork and, increasingly, self-assessment (Hanson 2006). Therefore, it is important for educators to support students in developing the skills to succeed in this environment.

Notably, traditional methods of tertiary teaching do not necessarily address these issues. For example, lecture-style teaching may promote a transmissive approach to learning that places students into a role of passivity and limits their cognitive engagement (Ramsden 2003; Tyler 1949). Students taught through traditional methods at school level and in higher-education settings have been shown to have problems applying knowledge, finding relevance in topics and transferring skills within and between disciplines (Astin 1993; Hanson 2006). However, by focussing on the process of learning, the abilities of individuals and the promotion of student involvement, deeper cognitive engagement can be achieved (Newble & Cannon 1995). Well-designed and well-implemented SCL activities have the ability to foster the development of these skills, which are required to succeed in contemporary society.

Posing the problem

Despite the perceived advantages of SCL, the adoption of SCL activities is not a trivial task for educators accustomed to working in more traditional formats, particularly those new to teaching. Information surrounding the SCL activities and the technology to support them is extensive and can be found in a range of journals from a variety of disciplines. Moreover, there are very few examples where the variety of practical SCL teaching issues is discussed in a single teaching context. Therefore, it may be difficult for an educator of any experience to determine what activities will best suit their teaching context and how to implement them successfully.

The difficulties for novice academics are compound. First, novice teaching academics lack experience. In most disciplines, new academics have been employed as discipline experts rather than pedagogues and have little, if any formal training or experience with university teaching. They may have only experienced the traditional lecture format of teaching and many are still developing their own teaching styles with little to no formal training. Second, they may not be well supported in their efforts to improve their teaching. Often, they may be working in relative isolation. They must seek out the information that links pedagogical approaches or teaching strategies, local considerations such as student and teacher characteristics and practical considerations such as the availability of learning technologies and teaching spaces. Third, they must manage the demands of early-career activity. They must deal with steep learning curves associated with the transition to university teaching and the demands of their own high academic workload. Together, these factors can make it very difficult for a new academic to make informed decisions about the use of SCL in particular teaching situations and to manage the additional demands of labour-intensive academic development.

This article is intended to support new academics who are teaching in traditional teacher-centred situations to make informed decisions about the implementation of particular SCL activities. It syntheses a body of SCL literature to provide an overview of three broad SCL strategies that can be integrated into traditional delivery formats such as lectures: inquiry learning, concept checking and just-in-time teaching (JITT). This synthesis provides an overview of each of the three types of SCL activities, and presents key considerations in the implementation of each of these three types of activities. The article concludes with the discussion of four further points that inform the implementation of SCL by novice academics in traditional university teaching contexts.

Background

The pedagogical foundations of SCL lie in constructivist learning theories and the related notions that (a) knowledge is constructed by students through active engagement with the learning process; (b) the results of such knowledge construction processes extend beyond instrumental learning of intended content to the development of transferrable knowledge and skills; and (c) constructed knowledge is, in some ways, qualitatively superior – for example, more personally relevant, more readily accessible for application or further construction and retained for longer periods (Cannon 2000; Kember 1997; Machemer & Crawford 2007). SCL places attention squarely on the student, as learner, and the activity of learning as both a means and an end in knowledge acquisition, skills development and the cultivation of attitudes and beliefs associated with having learned. At the heart of most SCL approaches are constructivist epistemological views that emphasise the personalised and idiosyncratic aspects of learning through the construction of meaning (Prawat & Floden 1994; von Glasersfeld 1995). Learning is seen as a result of building understanding through sense-making associated with exploration, observation and experience, amongst others (Jonassen 1999; Land & Hannafin 2000).

These constructivist views have helped educators draw contrasts between traditional, teacher-directed methods of instruction and more student-centred views of learning and teaching (Hannafin & Land 1997). These contrasts have, in turn, supported the emergence of more student-centric approaches to teaching, alternative views of learning and teaching roles, the development of student-centred learning environments and the application of particular technological tools to support SCL (Land & Hannafin 2000). Educators in the sciences, technology and mathematics, in particular, have reconceptualised the role of technology in teaching to support specific learning outcomes, such as critical thinking and problem-solving skills, as part of their broader work in education. The result has been ongoing development of the psychological, pedagogical, technological, cultural and pragmatic foundations of student-centred learning (Hannafin & Land 1997). As Hannafin and Land (1997) point out, "... student-centred learning environments are not simply dichotomous alternatives to direct instruction.... Any learning environment is ultimately shaped by its foundations and assumptions about learning, pedagogy, and the learner: As the assumptions change, the interplay among the foundations changes" (p197). Therefore, it is essential to support educators' efforts to implement SCL with some attention to its foundations.

Conceptual framework and approach

Practical decisions about implementing SCL within a particular course or context are informed by a number of considerations. As implied by the term "student-centred learning", there is a focus on learning – e.g., learning outcomes and the intended learning activity – and the implications for pedagogy, including both abstract teaching strategies and more-situated teaching practices (Steeples, Jones & Goodyear 2002). There is also a focus on student characteristics such as relative subject-matter expertise and prior learning experiences. Consistent with a focus on academic teaching practice, there is a focus on the traits of the teaching academic, including personality, a variety of teaching-related skills and professional goals. However, there are very few examples where these considerations are discussed in a single setting from the context of a new academic implementing SCL into traditional lectures.

This article is written from the perspective of a new academic working in a traditional, teacher-centred lecture setting, who is interested in enhancing the current lecture format to include SCL activities. This new academic is from a science discipline and has been through a trial-and-error process of attempting to implement SCL activities into a traditional lecture-style course. She has firsthand experience with the difficulties of trying to find relevant advice about the most commonly used SCL activities amongst the large body of (mostly positive) commentary.

This article organises advice for teachers related to high-level pedagogies associated with three types of SCL activities – inquiry learning, concept checks and just-in-time teaching – and highlights key considerations in the implementation of each. In doing so, it links the relatively abstract idea of student-centred learning with more-concrete teaching practices, in context.

Inquiry learning

Inquiry learning uses active learning (Bonwell & Eison 1991) to develop experimental and analytical skills rather than fundamental knowledge. The pedagogical aim behind these activities is to encourage students to progressively construct personalised knowledge and understanding by building upon previous knowledge through the exploration of data models, and by seeking additional information. In inquiry learning, teaching begins with question-driven inquiry as opposed to declarative knowledge. This is in contrast to traditional pedagogies where teaching is telling, knowledge is facts and learning is recall (Cohen 1989). In most cases, students are encouraged to work together in teams to examine data or explore models. A key outcome of this process is to get students to discover patterns that can help them organise information into meaningful "packets" that are more easily understood. Once a pattern is discerned, the teacher then helps the students extend learning from a foundation in their personal inquiry to more widely accepted forms such as the use of domain-specific terminology or wider discussions around the relevance and significance of the pattern. Then, carefully designed questions are used to support students' development of concepts. Once the concept or term is understood, this emergent knowledge is reinforced by applying the pattern to different problems (Spencer 1999). This type of activity is linked to the learning cycle as developed by Piaget (1964) and Karplus and Thier and the information-processing model developed by Johnstone (1997). Two of the commonly implemented inquiry learning activities are problem-based learning (PBL) (Barrows & Tamblyn 1980) and process-oriented guided-inquiry learning (POGIL) (Hanson 2006).

Research highlights a number of educational merits of implementing inquiry-learning activities instead of (or in addition to) traditional lectures: increased student engagement and motivation (Brown 2010), improved problem-solving and enhanced understanding and knowledge retention and applicability (Prince & Felder 2006). Students not only benefit from increased retention due to active, participatory learning in groups (Hanson 2006; Johnson, Johnson & Smith 1991; Landis et al. 1998), they also benefit from the development of higher-order thinking skills and problem-solving abilities, which result from the recognition of patterns (Bransford, Brown & Cocking

2000). Students who develop their own understanding and theories by investigating data and relating it back to what they already know show enhanced knowledge retention, in contrast to students who are told the meaning of theories.

Considerations in the use of inquiry learning:

Pedagogy

Intended learning outcomes: Inquiry learning is aimed at encouraging students to take ownership of their own learning, improve higher-order thinking skills and develop methods of learning. Learning situations that suit this approach require a "big-picture" idea to entice students to be motivated to learn, along with a model that can be tested, analysed and explored and established connections for the learner to rely on (from either everyday experience or previous content). This requires the teacher to determine the key question of the inquiry-learning activity, the important conceptsthe skills the students will need and the sequence in which they must be applied to develop the knowledge.

Content coverage: The use of inquiry learning in courses is often perceived to reduce content coverage due to the time required to implement activities. However, there is little evidence to suggest that inquiry learning negatively affects student grades or progression through subsequent courses (Barthlow 2011). In fact, it is suggested that the overall improvement to engagement, motivation, comprehension and problem-solving skills outweighs any negative consequences of reduced content (Eberlein et al. 2008).

Learners

Subject-matter expertise: The effectiveness of inquiry learning may be affected by the expertise and problem-solving ability of the learner (O'Shea 2003). The ability to comprehend inputs and solve problems is based on access to information stored in learners' long-term memory, and on how much new information can be processed. If too much new information must be processed before a problem can be solved, as in the case of a novice learner with limited relevant subject-specific knowledge, the cognitive load associated with the learning can be overwhelming. This can lead to the generation of errors in learning or, in worse cases, a failure to learn due to cognitive overload (Lister & Leaney 2003). Inquiry learning may be best suited, then, to moderately expert learners. Learners with relatively novice levels of subject-matter expertise will often need to rely on borrowing information from a teacher's long-term memory to solve problems and comprehend new knowledge. Novices may be better suited to learning through scaffolding using worked examples until their long-term knowledge builds up to a level that allows them to problem-solve without cognitive overload (Sweller 2006).

Learner expectations: One of the main aims behind inquiry-learning activities is that students develop their own knowledge. However, students entering tertiary education may have particular expectations about how they will be taught, often linked to their experience in traditional classroom settings with significant direction from the teacher. They may feel "threatened" when there is a requirement to work relatively independently of direct instruction (Felder & Brent 1996). Likewise, students may feel discomfort with unfamiliar learning processes and the demands of "learning to learn" in a more self-directed way. Both of these may affect their engagement with the learning activity, reducing its effectiveness. These issues can be overcome with two key practices: clearly communicating the pedagogical aims behind the activity and its relation to exam performance and improved higher-order thinking; and ensuring activities are well supported to help learners manage self-directed learning.

Teachers and teaching practices

Time commitments and question design: Courses with inquiry-driven activities require a significant input of academic time, especially around question design. Poorly designed questions, models, organisers or data sets can have a negative effect on learning outcomes (Hanson 2006). Questions should focus on the process of problem-solving and not on the solution, connect new concepts with previously learned concepts and excite interest to engage learning. Successful implementation of inquiry-driven courses requires that the academic interact with each group of students in-session; this can be quite difficult due to large student numbers or the design of the teaching space. The use of peer (student) leaders to facilitate sessions can alleviate this issue; however, peer leaders must be trained prior to each lesson to ensure they understand the expected learning objectives. This can have the negative impact of adding to the academic time commitment outside of session. In addition, an appropriate quantity of time must be allocated in each lesson to allow students to understand the problem, develop an answer and participate in a discussion on problem-solving strategies and the solution. Based on the problem-solving strategies and the solution, extra time may be required to further facilitate knowledge development. This can affect the ensuing lectures, which may ultimately disrupt the semester's syllabus structure.

Concept checks

Concept checks are used to enhance the traditional lecture or tutorial. They help shift focus from what the teacher presents to what students take in, engage with and understand. The technique involves asking questions at the end of a topic and allowing the students to respond as part of the class. Often the response process includes an opportunity for students to discuss their answers and refine their understanding through a process of explanation and negotiation. This is followed by a class discussion around the qualities of student responses. During this process, concepts can be revised or re-explained where required. This type of activity allows both the academic and the student to check understanding of material, and encourages students to participate in the learning by testing their newly acquired knowledge. Feedback is provided to both students and teachers: students get immediate feedback on their current understanding, and teachers get feedback on misconceptions and other issues that are affecting student understanding. This effectively allows an academic to tailor each lesson to a particular student cohort's abilities and knowledge.

The use of concept checks during lectures can have a number of positive effects on student engagement and learning. The act of breaking up a lecture can help students refocus on material and extend concentration, which is known to reduce significantly after 10 minutes (Bligh 2000). Concept checks can be used to avoid cognitive overload by presenting information in small, workable blocks. In addition, by taking time to acquire feedback about students' mastery of each new packet of information, student confidence in their own abilities can be improved. This point is significant given that students' confidence has a marked effect on their engagement and willingness to participate in learning (Snowman & Biehler 2000). The use of concept checks can also foster higher-order thinking skills and help link material and concepts. Moreover, this SCL activity encourages peer interactions, which have been shown to lead to improved student-learning outcomes (Crouch & Mazur 2001; Smith et al. 2009).

Considerations in the use of concept checks

Pedagogy

Intended learning outcomes: Judgements on the particular approach to and execution of concept checking depend on the goal of the concept check. Known-answer questions suit concept-checking where the goal is focussed predominantly on students learning facts or demonstrating understanding of concepts with clear right or wrong responses. In contrast, if the goal of the concept check is to stimulate higher-order thinking such as analysis, synthesis or evaluation, in addition to remembering facts, a reflective concept-checking activity may be better suited (Hmelo-Silver & Barrows 2006). By encouraging students to clarify the meaning of their answer through reflection, teachers can ensure that students are learning and not guessing the answer.

Learners

Subject matter expertise: Concept-check questions are in general developed by teachers with an explicit idea of what is being assessed and how they themselves as "experts" would work through the problem. This allows students to map their own learning through these questions and the following discussions. Concept-check questions can be used to help identify specific strategies and to model exactly where, how and why to apply the strategies to a problem. This type of learning suits a wide range of students. For example, with novice learners, content can be delivered in small packets, thus avoiding cognitive overload and allowing novices to "borrow" thought patterns from an expert. In contrast, when concept-check questions are used with expert learners who are applying concepts to scenarios with a very high level of difficulty, they allow students to gain feedback on their progress at each stage, thus helping them to gain confidence in their approach and avoid any serious learning misconceptions.

Teachers and teaching practices

Experience of the academic: The use of concept-checking has been shown to suit all levels of student maturity and expertise. However, the experience, goals and beliefs of the teacher may play a role in its successful outcome. Notably, reflective concept-checking requires the teacher to possess a repertoire of problems and strategies to reveal misconceptions and test ideas, which may need to evolve quickly as the discussion continues. In addition, given the possible tensions between more teacher-centric activities, such as lecture presentations, and more student-centred additions to lecture sessions, like concept checking, it may be difficult for a novice teacher who has never been exposed to SCL to recognise when they are inadvertently using teacher-centred approaches instead of the intended student-centred approaches. For example, a concept check where the teacher asks a known-answer question of a student and then the teacher elaborates on the answer is not necessarily a student-centred approach (Hmelo-Silver & Barrows 2006).

Mechanisms of questioning and response: The mechanisms by which questions are posed and responses are registered (e.g., hand-raising, classroom response systems, etc.) in this activity can also affect its success. Students will often be fearful of making incorrect statements amidst their peers or admitting to a lack of understanding (Landis et al. 1998). The manner in which questions are asked can be adjusted to suit the size of the class or access to technology. For example, the issue of negative peer reactions to making incorrect statements notwithstanding, in a small-group tutorial, it may be beneficial to determine which students individually have misconceptions; this is more easily achieved by hand-raising. In contrast, in a large lecture, hand-raising may only encourage copying due to peer pressure; in this case, a classroom response system would allow students to answer questions confidentially. However, with any mechanism, the academic must always be mindful to ensure that students are engaged with the process and that their answers are a true reflection of student knowledge (Slunt & Giancarlo 2004). This can be achieved through the use of individual follow-up questions in a tutorial or the use of another question that relies on the understanding of the first in a lecture.

Just-in-time teaching (JITT)

Just-in-time teaching is an SCL activity developed by Novak, Patterson, Gavrin and Christian for undergraduate physics courses. It has since been expanded to a number of other disciplines (Novak et al. 1999). This technique involves the use of online activities in the form of short-answer and multiple-choice questions that students are required to complete just prior to attendance at a lecture. Ideally, the questions should encourage students to read and engage with resources and focus on understanding concepts. The lecturer then views the responses "just in time" to inform the selection and presentation of lecture material based on the students' responses The questions can be designed either to review previous material, which creates the potential to identify misconceptions that can then be addressed in the lecture, or as a "warm-up" for the upcoming lecture, from which the lecturer can tailor the session to suit the students' existing knowledge.

The main educational merits behind the use of JITT are that it acknowledges that previous knowledge affects future learning, and it allows the teacher to understand how the learning backgrounds of student influence their current learning. Learning is enhanced when students can connect what they are learning with what they already know (McKeachie 2002). Importantly, this approach encourages and rewards students for staying up to date with material, without penalising misconceptions (Novak et al. 1999; Slunt & Giancarlo 2004). Interestingly, there is evidence that the JITT approach results in better student performance in exams compared with a concept-check activity (Slunt & Giancarlo 2004).

Considerations in the use of JITT

Pedagogy

Intended learning outcomes: The JITT approach has two intended outcomes: it helps students prepare for in-class learning, as participation in pre-class activities has been shown to improve student performance (Moravec et al. 2010); and it helps teachers learn where misconceptions exist and determine the knowledge base of the students, thus allowing for a more individualised lesson plan. The type of activity can also affect the intended learning outcome. For example, the JITT approach allows the teacher to introduce examples with high currency, in the case of course-related news stories that show the relevance of the concepts in the course to the real world and their profession.

Learners

Student engagement: This approach relies on high levels of student participation and engagement with the pre-session question tasks. It is important to encourage students to attempt the questions and read the material ahead of time to ensure that a representative group has been surveyed. One method that has been shown to work is the assignment of marks for participation; for example, students can receive credit (e.g., in the form of "marks" as part of course assessment) for responding. This can support student motivation (Slunt & Giancarlo 2004). However, JITT is not aimed at students always giving the correct response; it is about gauging current knowledge. Awarding credit for correct answers may motivate students to focus on completion rather than learning; for example, to seek the correct answer from peers rather than submitting their own answers (Patterson 2003). Therefore, while it might suit to award marks for a correct answer to encourage engagement with the material, the majority of marks should be associated with participation.

Teachers and teaching practice

Personality of the academic: The success of the JITT strategy depends heavily on the abilities of the teacher to respond to emergent information and tailor sessions accordingly. This type of activity will not suit all personalities. The lack of preparation time means that teachers must be extremely flexible and confident in their own knowledge and ability to give a lecture "on the fly", or extremely prepared to react to any eventuality.

Teaching material: The use of PowerPoint presentations to give lectures or the provision of formal notes ahead of class may be limited in a JITT context, as the time between recording the results from the JITT activity and the lecture may not permit the development of new slides or notes to suit the students' learning needs. Therefore, the academic may need to use a whiteboard or an overhead projector to present information. This may have consequences for automated lecture-recording systems or lead to students focussing more on transcribing notes than on the information. It may also be more difficult to implement this type of activity with large student cohorts where lectures are given in repetition, as the background knowledge may differ between lecture cohorts.

Workload: The implementation of JITT requires a significant ongoing time input from the teacher. Not only is there a need to prepare appropriate questions according to the intentions of the JITT strategy (i.e. as either review or warm-up), there is also the need to review the majority of student responses in, for example, the hour directly preceding the lecture. This presents a number of practical challenges for academics with heavy workloads and limited preparation time. In addition, it may also increase student workloads, as it requires students finding time ahead of class to read the material and answer the questions. The addition of preparatory work for students may imply the need to adjust the student workloads from ex post facto task work to preparation for in-class learning activity.

Discussion

An overview of various SCL techniques' merits and potential issues is presented in Table 1.

Table 1: Overview of Three Common SCL Techniques

	Inquiry Learning	Concept Checks	Just-in-time teaching
Merits	• Improved student results • Knowledge retention is increased through engagement and enhanced student-student interactions (Johnson, Johnson & Smith 1991) • Problem-solving skills are improved where knowledge is constructed in patterns and not independently • Knowledge is developed in a manner similar to how research is conducted, rather than in isolated topics	• Improved student results • Students receive immediate feedback • Lectures are interactive • Students engage in peer instruction • Sessions are tailored to learner needs • Breaking up the lecture can extend student concentration • Students can demonstrate comprehension, which can increase confidence in a topic	• Improved student results • Lectures can be tailored to student knowledge • Students are encouraged to read material ahead of time • Students receive immediate feedback on their understanding of concepts • Misconceptions in learning are highlighted regularly
Potential Issues	• Very time-intensive for the academic, especially if peer (student) leaders are used (Lewis & Lewis 2005) • Trade-offs exist between number of topics covered and improved learning outcomes (Farrell, Moog & Spencer 1999) • Students have preconceived ideas about how they should be taught and may feel cheated if another approach is taken (Cook & Leckey 1999) • Very well-designed questions are required to achieve learning objectives	• Student responses may indicate true engagement, or just guesses (Slunt & Giancarlo 2004) • Responses can be easily affected by peer pressure (especially with hand- or card-raising responses) • In-session checks can be time-consuming • Preparation, particularly in the first iteration, is time-intensive for the academic	• Academic must be flexible and able to respond quickly • Little time to plan a lesson • Lesson plan changes each year • Lectures given in repetition may differ significantly due to differences in student cohorts • The academic must devote considerable time outside lectures: a variety of questions needs to be developed and student answers must be analysed before each class

In considering support for integrating SCL activities into traditional university teaching, we make four observations that help inform practical decision-making related to SCL implementation.

First, the demands for student interaction and perceptions of SCL activities vary at different stages of learning and exposure to higher education. SCL activities emphasise increasingly self-directed learning, where students are encouraged to take control for their own learning and develop higher-order thinking skills. This can be quite challenging for a student who may have only experienced traditional, teacher-directed learning formats, because it implies a need for students to "learn to learn". For some students, a change from "knowledge presented as fact" to the "thinking and working" processes used in SCL can result in hostility and resistance to learning. In some cases, the psychological steps associated with trauma and grief can also be observed in students transitioning from teacher-directed to self-directed learning: shock, denial, strong emotion, resistance and withdrawal, struggle and exploration, return of confidence and integration and success (Felder & Brent 1996; Woods 1994). This is often more noticeable amongst first-year students, who are accustomed to accepting knowledge passively from teachers and may be confronted with cognitive overload as a result of the demands of student-directed learning. In contrast, higher-year students have often already developed an understanding of how they learn, and possess both core knowledge and connections between knowledge that may aid their engagement with many SCL activities. To minimise potential hostility and resistance, especially among first-years, it is important to employ a developmental approach to SCL and provide enough structure and guidance to students so that they don’t feel isolated by new teaching methods, but are instead aided in their journey from dependence to intellectual autonomy (Felder & Brent 1996; Kloss 1994).

Second, while improved student-learning outcomes provide an essential motive for the implementation of SCL activities, they are only one consideration behind SCL; the teacher’s personality and beliefs and the potential rewards are also important. The pedagogy behind SCL may focus on the student as the learner, but the role of the teacher is paramount in the success of any activity. SCL activities encourage students to think and challenge themselves and their ideas, and to follow pathways of interest (especially in guided-inquiry activities). This requires teachers to be flexible and adaptable in both their interactions with students and the structure of a lesson. New academics and those lacking confidence may feel quite vulnerable during SCL activities, not least because the competence and expertise of an academic can be tested by students who raise unexpected questions or when questions lead beyond the academic's expertise. Students often expect academics to be all-knowing, and a lack of ability to answer a question may lead to a student altering their perceptions of the teacher. This can have consequences for the teacher: loss of respect from students can cause class disruptions and reduced end-of-semester teacher evaluation scores as students are often required to rate their beliefs of a teacher's mastery of a topic. There is very little research in the area of how new academics cope with the inclusion of SCL activities; much of the work focusses on academics who have realised with experience that their students are not learning the desired skills or leaving with workable knowledge (Ribeiro 2011). These academics already have the confidence, skill sets and broad knowledge basis to cope with challenges from students who are following pathways of interest. It is important that each academic considering the implementation of SCL considers how each type of SCL activity suits their own personality and confidence levels as they develop as a teacher.

A common thread in the literature is the lack of a clear definition of "student-centred learning". Teachers alter practices to suit their own beliefs, some of which were developed during their own experiences as a student (often in teacher-centred environments) and as a teacher (Pederson & Lui 2003). Therefore, it can be expected that a teacher’s belief of what student-centred learning is will affect both how the activity is implemented and its outcomes. New academics may unknowingly present or implement activities from a teacher-directed view due to their unfamiliarity with SCL, their lack of experience or their ignorance of SCL's potential. A mismatch in beliefs and actual implementation may be most pronounced in teacher-student question-answer interactions (Hmelo-Silver & Barrows 2006). Academics need to examine the pedagogy behind all their interactions and goals to ensure they are guiding learning rather than acting as the source of all information.

It is also important to be mindful of the benefits of SCL for the development of teaching skills. The inclusion of SCL activities helps teachers to empathise with students: to understand how students think and what interests them, and to identify their misconceptions. This has the potential to contribute to an academic’s development as a teacher. This is an important benefit, especially for academics who come directly from graduate schools or research environments with little or no pedagogic content. This is a little-promoted aspect of the implementation of SCL activities;

however, it is one which could be expected to have a positive impact on student evaluation scores, which in turn are linked with career advancement.

Third, the time and personal effort required by an academic to implement SCL activities – in terms of both preparation and process – should not be trivialised, especially for new academics. Lesson plans need to be flexible, as the direction of the course may need to change to cope with student interest or to solve misconceptions. Unfortunately, the time spent in teaching and preparation is not always valued in university environments, particularly in research-intensive universities, where academics acutely feel the tension between teaching and research during the promotion and award processes. Therefore, while the inclusion of SCL activities may result in better learning environments for students and promote higher-order thinking skills, which are vital for research, academics need to seriously consider how the time spent implementing an activity might affect their career advancement. This is probably especially true for new academics who are facing a range of challenges: establishing themselves as a researcher in a new environment (developing their own research ideas, attracting and training graduate students), developing as a teacher (writing lectures, delivering content for the first time, managing student behaviours) and coping with ever-increasing administrative duties. Due to their high workload, it is important that new academics prioritise effort towards outcomes that will benefit them – for example, provide opportunities for professional development or career advancement – as well as their students.

Fourth, one of the key strategies in achieving successful implementation of SCL is the emphasis on clear communication of the aims, potential outcomes and expectations of an activity. SCL activities are designed to encourage students to take control of their own learning. This requires students to be motivated and inspired to engage with the learning process. This can be achieved through both extrinsic and intrinsic motivators. However, extrinsic motivators such as assessment will not work for all students. Therefore, it is important to explain the value of each activity and the expected outcomes in broader terms rather than just focussing on improved grades. Students must be aware that the skills learnt and improved (e.g. critical thinking, problem-solving) through engagement with SCL will help them in their careers, and give them the skills to be lifelong learners. In addition, the link between what has been previously studied and the current content, in reference to the bigger picture, will also help students understand the value of the activities. It is important that these discussions are continued throughout the semester, rather than only at the beginning, to ensure students remain aware of the value behind each activity.

Summary

The integration of SCL activities into traditional university teaching is not a trivial task. As with many academic development processes, the implementation of SCL can be quite demanding. It requires careful consideration of the intended learning outcomes and the corresponding implications for teaching, the characteristics of learners and the demands on teachers. This article has highlighted these considerations in the context of three SCL strategies: inquiry learning, concept checks and just-in-time teaching. Attention to these considerations is likely to improve novice teaching academics' efforts to integrate SCL into their teaching, and may increase the likelihood of realising the benefits of SCL as a supplement to more-traditional teaching in higher education.

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