THE JOURNEY TO HIGH LEVEL PERFORMANCE: USING KNOWLEDGE ON THE NOVICE-EXPERT TRAJECTORY TO ENHANCE HIGHER EDUCATION TEACHING

Sarah Moore, University of Limerick, Geraldine O'Neill, University College Dublin and Terry Barrett, University College Dublin

Introduction

In 1968, Benjamin Bloom presented a formidable challenge to educators by arguing that most students can excel if they learn under appropriate conditions. He gave teachers guidance on how such "mastery learning" could be generated: by combining cognitive entry behaviours, affective conditions and enhancing the quality of teaching, 90 percent of students could achieve what only 10 percent of students typically achieved without these interventions and orientations (Amirault and Branson, 2006). Embedded in Bloom's recommendations were ideas about how experts could interact meaningfully and positively with novices in any field. Since then, the "novice–expert" trajectory has implicitly shaped the ideas of educational theorists across a wide range of disciplines. And yet, the daily practice of teachers in higher education is rarely informed by knowledge and insights associated with the study of this trajectory.

Formalised interactions between novices and experts are an institutionalised part of the daily work of higher education institutions. Notwithstanding the exceptions and misgivings that teachers and learners may experience about the use of both terms, the differences between expert and novice approaches to ideas, knowledge, learning and skill development offer useful insights for those involved in higher education. This difference forms the central focus of this chapter.

This chapter reviews some of the key literature on the differences between novice and expert behaviour in learning and professional development settings. It argues that it is in these different patterns and orientations that we can find some intriguing as well as practical ideas for the development of better learning environments in higher educational settings. It proposes that the characteristics of and differences between novices and experts provide us with among the most important clues available to help support the "journey to competence". And it suggests that understanding the novice–expert gap gives us vital knowledge that can guide the design of learning environments that ensure that the largest numbers of students achieve the greatest levels of mastery over their disciplines (while also recognising the length of time that it really takes to develop high-level competence in any field). The chapter concludes by recommending a range of strategies that could help to bridge the gap between novice and expert, a gap in which many transformative experiences can occur, and yet a gap that often feels insurmountable from the points of view of the new learners and the experienced teachers who encounter it.

How expertise is acquired

The literature in the fields of expertise and expert performance suggests that there are several key features associated with the process of expertise acquisition. These features include the:

- "10-year rule"
- need for deliberate practice and immersion
- movement through different phases of competence

- development of automaticity.

Each of these features is outlined briefly below.

The "10-year Rule"

Although aptitude and natural ability clearly play a role in the development of high levels of expertise, research suggests that individual talent may be less important than other factors. These factors include time, dedication, support and interpersonal orientation (for example, Ackerman and Beier, 2006; Krampe and Baltes, 2003). No matter how brilliant or talented an individual might be, it seems that there is no way to short circuit the journey from novice to expert. Equally, even when people do not possess particularly high levels of initial aptitude, the literature suggests that if they "stick with the programme", the likelihood of becoming expert is quite high. Many commentators agree that the average amount of time necessary for someone to experience the gradual transformation from novice to expert is about 10 years. Although some have found that certain experts can accelerate their learning, the 10-year rule is a recurrent and persistent finding across a range of domains (for example, Simon and Chase, 1973; Ericsson *et al*, 1993; and Sosniak, 2006).

Deliberate Practice and Immersion

It is not simply the passage of time that facilitates the development of expertise. The "decade to expertise" needs to be characterised by high levels of motivation, persistence, opportunity and aptitude, and must include dedicated periods of assiduous practice, self-assessment and evaluation by others, complete immersion and formative feedback to support the process. Ericsson (1996, 2006) has emphasised that as well as time and practice, the acquisition of expertise requires a special level of engagement, which he refers to as "deliberate practice" and which is characterised by "full mental engagement, the focus on overcoming current performance boundaries" (Ericsson, 2006, p. 238).

Movement through Different Stages of Competence

The literature on expertise also suggests that there are different, roughly identifiable phases on the journey to expertise and high-level proficiency. Phases that have been identified in the theory tend to approximate those described by Dreyfus and Dreyfus (1986) as novice, advanced beginner, competent, proficient, and expert or "master" performer (see Table 1). Many curriculum development models recognise that there are different levels of engagement in learning and try to reflect those levels in the planning and scheduling of different topics, skills and challenges. Even when explicating the different levels of engagement and competence that might be invoked at different stages of a programme, however, dialogue about curriculum development does not always pay specific attention to the important differences between novice and expert (such as those outlined in Table 1). Furthermore, despite what is known about these differences, there remains inadequate guidance within different fields about how both teachers and students need to adjust their teaching and learning practices and processes as the gaps between teachers and learners start to close.

Table 1: Levels of Proficiency
(based on Dreyfus and Dreyfus, 1986)

Novice	• Rigidly adheres to taught rules or plans • Has little situational perception • Has very limited discretionary judgement • Has no experience base on which to integrate an assessment of challenges or problems
Advanced beginner	• Needs guidelines for action based on some aspects of the situation • Has limited situational perception • Uses some prior experience to build a base ready for competence
Competent	• Copes with crowdedness • Sees action at least partially in terms of long-term goals • Is capable of conscious deliberate planning • Has standardised and routine procedures
Proficient	• Sees problems holistically • Is efficient at identifying most important aspects and issues
Expert	• Does not rely on rules or guidelines • Has intuitive, deep, embedded understanding of situations, and understanding that can quickly be acted on

The Development of Automaticity

The well-documented development of automatic routines among experts (for example, Posner and Snyder, 1979; Procter and Vu, 2006) may be a key reason for the difficulty experts have in articulating their knowledge to novice audiences (Matthews *et al*, 2000). The development of automaticity seems to be a phenomenon that prevails across all domains. The gradual transformation of knowledge from explicit and conscious to tacit and unconscious means that experts do not always know just how much expertise they possess. They may underestimate the amount of basic information that novices require to begin developing proficiency in the field. In addition, even where experts do realise the importance of basic, introductory information, they often encounter significant difficulties in articulating this information in ways that can be understood and used by novices.

Differences between novice and expert orientations

The four features of expertise acquisition outlined above have implications for the differences between expert and novices, which in turn affect the ways in which experts and novices interact in educational settings. Indeed, experts may be highly proficient in their own fields, but their very proficiency may in fact limit their effectiveness in educational settings.

For example, experts underestimate the length of time in which a novice will complete a task. Also, as their expertise grows, their ability to understand the challenges faced by novices diminishes (for example, Hinds, 1999). It seems clear, then, that as experts gain expertise, their ability to explain things to novices becomes somehow impaired. Experts often find it difficult to explain or expand on certain aspects of their knowledge and skills,

because these knowledge and skills sets are no longer explicit, having become embedded in their practice. Of course, novices may suffer from the same difficulty, but the impact and implications are less significant, because they are not called upon as frequently to explain and lead understanding about the things that they know.

Chi (2006) identifies other deficiencies of experts, including:

- domain limitations – experts are increasingly unable to instruct outside their specific area of expertise
- overconfidence – experts have been found to overestimate their own capabilities in a range of settings
- tendencies to "gloss over" – evidence suggests that experts fail to attend to details on the surface of a case, problem or issue
- over-reliance on contextual clues – the accuracy of experts' responses to problems are significantly augmented by, or even dependent on, key contextual information or background data, so that the absence of this data may significantly undermine expert performance
- inflexibility – experts may be quite rigid in the application of their skills, and become easily thrown if the rules of engagement change or move outside the specific domain over which they have mastery.

Essentially, whereas experts think in intuitive, unconscious and automatic ways (Eraut, 1994), novices use analytical, conscious and deliberate thinking processes (Moore, O'Maidin and McElligott, 2002). Whereas experts are faster and more fluent, novices are slower and more stilted in the ways they interact with topics, and in the ways they think, talk and carry out tasks in the target domain (Matthews *et al*, 2000). Experts perceive data and organise it into large meaningful patterns (Glaser, 1998), whereas novices perceive data in disjointed and fragmented ways, often having difficulty in seeing how data might fit together or be linked. But on the other hand, experts struggle to explain the basic rules of their expertise (Matthews *et al*, 2000), whereas novices can access the steps in recently acquired skills much more easily and clearly.

The positive pedagogical potential of novice-expert interactions

Despite the differences between them, it is worth remembering that novices can do many of the things that experts can. In the right conditions, they can quickly demonstrate the foundations of competence on which experts have built more complex routines, links and ideas. Furthermore, experts can be understood very easily and naturally "as long as the principles of natural conversation apply" (Hogan, Rabinowitz and Craven, 2003).

Therefore, the principles of natural conversation need to be cultivated more assiduously in higher education environments. Natural conversation requires an arena in which all voices have an opportunity to be listened and responded to. It requires an orientation in which experts need to understand the foundations of misunderstanding and the opportunities for insight among the novice groups with whom they interact. The fundamentals of effective dialogue probably require teaching and learning in small groups. Despite the ways in which technology enhances and facilitates communication, it still has not found (nor we argue, will it ever find) a way to overcome the fundamental need for the establishment of genuine human relationships that only small group learning can provide.

Expert teaching is a mix between known, planned routines and flexible responsiveness to the specifics of any one classroom situation. Torff (2003) has shown that as teachers become more experienced and accomplished, and as long as the teaching context allows and encourages this, teachers can move from a focus on content and curriculum, to a focus on their learners' acquisition of higher-order thinking skills.

Recommendations and implications for the practice of teaching in Higher Education

Even this brief review of some of the key literature on the characteristics of expertise suggests a range of issues that should be of concern to educators in relation both to policy and practice.

Many of the findings suggest that experts become faster and less obvious (sometimes even appearing lazier and more complacent) in their approach to problems within their domain of expertise. Their expertise gives rise to cognitive and practical shortcuts that generally serve them well. But experts also have zones of comfort that may become a sort of methodological fixedness, an inflexibility that may restrict their ability to generate alternative solutions, to consider details or to recognise new patterns and ideas that may not fit into their learned ways of doing things. What does this mean for experts teaching novices?

To begin with, novices can teach experts about aspects of a problem: by asking "naive" questions, they can help experts to see problems and to combine ideas in new ways. This means that experts should listen to novices' question not only in order to answer them, but also as a means of critiquing their own expert approaches and orientations towards problems. A related issue here is that novices may be more thorough in their analysis of problems and concepts, and in this thoroughness may find interesting possibilities and ideas that can escape experts.

The observed tendency in experts to underestimate time requirements for novices to complete certain key tasks carries quite serious implications for educational settings at all levels. After all, curricula are generally designed and scheduled by experts, which means that an under-allocation of time required for practice may be persistently built into the design, development and delivery of educational programmes across a range of domains. Indeed it could be argued that the time allocated to many curricular activities is calculated on the basis of past practice alone. Therefore, evidence-based curriculum design should analyse and include the time needed for novices to develop progressive levels of expertise.

Experts may be inflexible when it comes to allowing novices to begin from different starting points and take different routes to the same learning outcome. As diversity increases in higher education environments, this challenge becomes intrinsically more problematic anyway, but may pose particular difficulties for highly competent experts whose problem-solving activities have become quite automatic, formulaic and rigid, despite their effectiveness and complexity. This suggests that teachers should be prepared to give their students permission to confront a problem from different perspectives while recognising that teacher routines and patterns may be among the most efficient ways of reaching solutions without necessarily being the most appropriate for their students at a particular point in time. Sometimes, more circuitous routes aid students' capacity to understand even if eventually they abandon some steps and approximate more closely the patterns that experts typically use.

Expertise is revered in academic settings, and signifiers of expertise are often the basis on which promotion and reward decisions are made. No wonder then that there may be a tendency for experts to protect their power. It is not unusual for students to report a feeling of being bamboozled as teachers work to maintain a mystery about their genius. The opposite type of orientation is needed to create healthy, functional learning environments – experts who are secure in their knowledge domains but humble enough to recognise the brilliance of others (that is, they can acknowledge both the giants on whose shoulders they stand as well as the budding genius of their students). Brilliance among students can be developed. Bamboozling students and not recognising or allowing for gaps in knowledge at best gives rise to mediocre learning environments and at worse to the kind of fear and shame that is associated with impoverished, Machiavellian learning experiences.

Having outlined some of the problematic issues that arise from the differences between novices and experts in educational environments, we turn now to a discussion of practical ideas for enhancing those environments by making the most of the novice–expert relationship.

Peer-supported Learning

The co-option of experienced students as peer supports for novice students is a proven strategy for bridging the gap between novices and experts in academic environments, because experienced students tend to be relatively close to novice students, yet they have also learned some of the important rules, routines and skills of academia. On a behavioural level, peers can mediate conversations that might otherwise be incomprehensible or difficult to penetrate for the new university student; they can provide candid information to teachers that can help to improve teaching performance.

Novice-led Conversations

Traditional academic learning environments are teacher led. Both teachers and students can turn this around in the interests of bridging the novice–expert divide. To begin with, it is important to coach teachers to take less of a lead at key points, to slow down and to prompt student-led conversations. In addition, it is similarly important to coach students to ask questions, to probe lecturer perspectives and to demonstrate the ways in which they are navigating (or not navigating) the material they are expected to learn. This can empower students to make the most of the conversations they have with experts in a particular field. Students can ask teachers to explain in several different ways: “Can you help me to understand this better by comparing it to something else?” “Can you go a bit slower because I find this part quite difficult” “Can you say that again?” “Can you try to rephrase what you have just said?” “Can I try to explain what I think you have said in my own words?”

Problem-based Learning (“Authentic Tasks”)

Problem-based learning (PBL) is founded on the principle that real-world problems are multidisciplinary, ambiguous, poorly structured and challenging. Introducing PBL environments is an effective way of ensuring that novices engage in challenging but motivating learning settings, with the facilitation, advice and support of experts. The dynamics of learning are structured by the teacher but very quickly become led by the novice students themselves. PBL proponents argue that the PBL movement is one of the most important and potentially transformative approaches to teaching in higher educational contexts and that it is capable of creating more authentic tasks for learners. PBL is a demonstrated route to changing the routines and patterns of interactions between novices and experts.

Teacher Training in the Science of Learning

It is timely now to call for a more fully developed approach to the study of novices' learning patterns and to help experts to design learning environments with these observed patterns and routines in mind. It is time to train and develop our expert academics in the "science of learning", so that their teaching approaches and methods can occur with a clear understanding of novitiate frameworks, key stepping stones and "threshold concepts". Although much work has already been done to disseminate and develop an approach that encompasses a greater understanding of learning, it is important to co-opt teachers themselves in this investigation. This is one of the key ways that a link between teaching and research can be achieved, a goal that is often central to the strategic objectives of universities across the globe.

Integration of Novice–Expert Relationships to Established Diversity Frameworks

An understanding of the importance of engaging with learner diversity has become increasingly central to effective teaching and learning. For example, Carroll (1963) showed that learners are diverse in the time they need for learning (aptitude), the time they are willing to spend on learning (motivation and perseverance), and the time they have for learning (opportunity). All these factors interact to explain the differences in performance among learners. These are only some of the variations that require educators to build different bridges in the same learning contexts. Similarly, multiple intelligences (Gardner, 1993), learning styles (Kolb, 1984), cognitive styles (Hayes and Allinson, 1998), personality differences and other sources of diversity all play themselves out in the classroom and other learning settings, and have been recognised as important considerations. We argue that novice–expert differences should become a stronger and more considered part of the dialogue that focuses on diversity in higher educational settings.

Deconstruction of Implicit Knowledge

Ford and Addams Weber (1992) have suggested that a science of knowledge elicitation is necessary for novices to gain the benefits of experts' competence in a way that can be readily absorbed and used by them. Other researchers suggest that "protocol analysis" (for example, Ericsson, 2006), which offers an arguably clearer and more accessible alternative to other approaches (such as directed questioning and introspection), can show more easily what is happening inside the heads of experts, and make these protocols more accessible to novices.

Opportunities for Immersion

We know that novices can very quickly pick up and practise expert routines and that engagement is an extremely important factor in fostering expert-type orientations. The more immersed and engaged students are, the more likely it is that they will acquire the competencies of experts more quickly and effectively. Csikszentmihalyi (1999) shows that engaged activity for optimal performance requires challenge and skill; total immersion; the absence of both time-consciousness and self-consciousness; clear goals and feedback; and a feeling of being in control, at least to some extent, of the learning outcomes to which students have subscribed. All of these criteria should be considered when designing and activating positive learning environments in higher educational settings.

A Focus on Motivation and Willingness to Engage in Dedicated Practice

Given the 10-year rule discussed above, it seems reasonable that formal education would strive to achieve as much immersion as possible within a programme of study and development. The most robust way of ensuring immersion both within and outside formal

contact hours is to catalyse student motivation, curiosity, interest and stimulated engagement from the very start of the programme. This can be achieved through a good knowledge of students' points of reference, their realms of interest and the features of their own experiences that are likely to motivate their willing immersion within a field of expertise. Good teachers naturally invoke their students' curiosity and interest.

Respect for the Knowledge Base of Experts

None of this suggests that we do not need experts. Universities would indeed be impoverished without their active presence. It is not possible to build knowledge societies, scientific orientations or critical thinking routines without the persistent input of those practitioners who are already fully immersed and highly competent in their fields of expertise. But we must also nurture the capacity for those experts to take a critical look at how their expertise can impede as well as support effective learning. Indeed, in the novice–expert literature, it has been established that one of the most common characteristics of highly talented individuals is the experience of having "studied with a master teacher – a teacher who has considerable standing in the field and who has helped to prepare others who are known for their accomplishments" (Sosniak, 2006, p. 298). This kind of intense mentorship should be facilitated in higher educational settings.

Intensive Exposure of Novices to Experts in Egalitarian, Open, Honest Contexts

Bloom once noted that in the quest to find out the "characteristics of talent", "we were looking for exceptional kids, and what we found were exceptional conditions" (Carlson, 1985). This should be one of the most encouraging and yet one of the most challenging findings possible for educators, pedagogues and teachers across all fields. The message is that it is possible to create outstanding learning environments in which students of many backgrounds and inherent abilities can thrive, participate, and excel. These environments need resources, climates, cultures, commitment, time and effort. But these environments can and do exist. They rely on the existence of experts but also on the way in which learning environments connect these people to students and foster a multi-directional learning process with novices teaching experts at least as often as experts impart their wisdom to those less experienced and accomplished as themselves.

Opportunities for "Masterclass" Activities after Graduation

Given the "10-year rule" associated with the acquisition of high-level expertise, it would make sense for higher education institutions to offer support for and continuity of learning beyond the initial period of education. Similarly, it would seem that the total immersion of a four-year programme or the mixed immersion of part-time programmes could be enhanced by the regular availability of expert input for even longer periods of time.

Conclusions

This chapter has examined the differences between novices and experts and the implications for higher education environments. We have not suggested that there is a simple or even desirable way to accelerate the journey from one level of competence to the next. Indeed, false acceleration or inappropriate "hot-housing" of skills could have detrimental effects or create fragile levels of expertise that do not reflect the robust competence frameworks of the real expert. Rather, we are suggesting that educators can benefit from an assiduous examination of the key stages of the journey, as part of a firmer commitment to the science of learning across all disciplines. Part of this science involves incorporating a strong, evidence base into educational design and development activities, in this case evidence about the differences between novices and experts. This would enable teachers and

educational developers to better combine the perspectives and experiences of both experts and novices with the aim of creating more effective learning environments. If we can ensure that the expert voice is not lost on the novice learner, while the novice voice finds a way of being heard, we may move closer to Bloom's vision of all students excelling and mastering any subject.

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