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Enhancing the development of pharmacy education by changing pharmacy teaching

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Abstract
In this paper, we present a model which describes the main elements and aspects of teaching and learning in pharmacy education. We first explore what quality of teaching and learning means. From this information, we concentrate on pedagogical implications to change pharmacy teaching to improve the quality of learning. In the final section, we summarise the importance of developing the pharmacy teaching due to the demands of Bologna process, lifelong learning in working life, and university staff development.

Keywords: *Learning, pedagogical changes, pharmacy education, teaching*

Introduction

In the field of pharmacy lifelong learning is a necessity. Today's pharmacists should continuously develop their expertise with the aim of being able to succeed in the ever-changing domain of work. The basis for expertise and for working life is established during higher education. Pharmacy education should correspond to the needs of working life and foster a good quality of learning in order to produce pharmacy experts for challenging, multidisciplinary assignments. Most importantly, pharmacy education should prepare students for lifelong learning.

In addition to the content of the curriculum, it is necessary to also pay attention to pharmacy teaching in itself. Teaching methods and teaching ideology are related to learning outcomes. Recent studies clearly show that there is a match between the approaches that teachers use and those that students consequently adopt (Marton & Booth, 1996; N. Entwistle & A. Entwistle 1997; Marton & Säljö, 1997; Prosser & Trigwell, 1999; Trigwell, Prosser, & Waterhouse, 1999; Kember & Kwan, 2000; Prosser, Ramsden, Trigwell, & Martin, 2003). Furthermore, studies emphasise that a student-centred approach to teaching is more effective in enhancing the quality of students' learning outcomes (Marton & Säljö, 1997; Prosser & Trigwell, 1999; Trigwell et al., 1999; Entwistle, Skinner, Entwistle, & Orr, 2000; Ramsden, 2003).

The aim of this article is to discuss the factors, which affect the learning process in pharmacy education and particularly lifelong learning. We discuss the relations between teaching and students' learning, this includes teachers' approaches to teaching and students' approaches to learning as well as factors associated with good practices. The main elements and aspects of the article are summarised in Figure 1, where the authors have modified the original model adopted from Prosser & Trigwell (1999) (see also Biggs (2003); Entwistle & Walker (2000); Richardson (2005a)). The model describes the context of an individual teacher and student in a complex teaching/learning system. The main purpose of this model is to summarise the aspects of this complex teaching/learning system and draw teachers'

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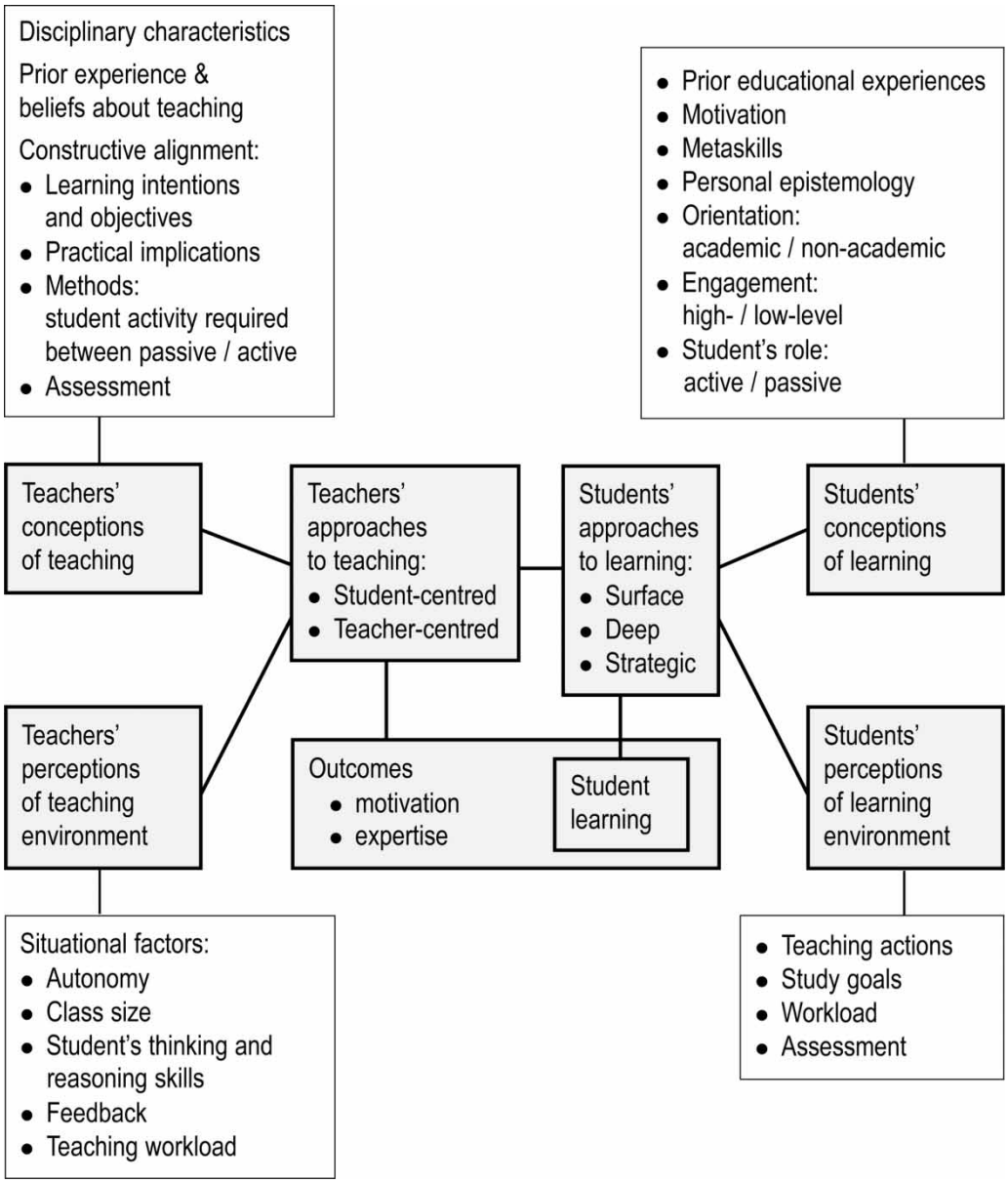

Figure 1. Main elements and aspects of teaching and learning.

attention to it. Teachers' and students' perceptions are especially in focus in an effort to understand the differences between individual actions in the same learning situations. Finally, another aim of this article is to suggest some practical ideas for improving the quality of pharmacy education.

Learning to teach

During the past decades research into higher education has concentrated on setting standards and defining the quality of teaching and learning (Vermunt, 1996; Marton, Hounsell, & Entwistle, 1997; Bowden & Marton, 1998; Prosser & Trigwell, 1999; Bereiter, 2002; Hativa & Goodyear, 2002a; Biggs, 2003; Ramsden, 2003). Quality has been discussed worldwide, pointing out criticism against traditional teacher-centred teaching. New perspectives of this discussion underline the importance of the students' active role as learners and the interactive relationship between teachers and students (Bereiter & Scardamalia, 1996; Trigwell et al., 1999; Entwistle et al., 2000; Kember & Kwan, 2000; Martin, Prosser, Trigwell, Ramsden, & Benjamin, 2000; Prosser et al., 2003; Trigwell & Shale, 2004; Richardson, 2005a; Vermunt, 2005).

Biggs (2003) defines good teaching as enabling all students to achieve a higher cognitive level of learning. According to this definition, students construct their own knowledge so that the learning is effective and meaningful for them. Furthermore, students need to develop effective learning strategies as well as the metacognitive skills to reflect on their learning. Teaching should encourage this kind of deep approach to learning, which provides for the achievement of better

learning outcomes. Biggs's definition of good teaching requires an improved teaching/learning environment that suits both teachers and students, and which facilitates high-quality learning. Both teachers and students need to co-operate while modifying shared learning objectives and negotiating suitable practices in the various teaching/learning contexts (Entwistle et al., 2000; Hativa & Goodyear, 2002b; Biggs, 2003; Segers, Dochy, & Cascallar, 2003b; Richardson, 2005a).

According to Biggs (2003, p. 9), the aims of university courses commonly are "theorising, generating new ideas, reflecting, applying and problem-solving". Pharmacy is no exception. In fact, maintaining expertise in working life requires a constant updating of knowledge as the development of new medicines, drug preparations, and medications is very rapid (European Pharmaceutical Students' Association (EPSA) & International Pharmaceutical Students' Federation (IPSF), July 1999; FIP International Pharmaceutical Federation, 2000). Pharmacists must possess good learning skills, which should already be enhanced during their study years.

Students' learning

Academic students do not automatically have a higher level of thinking skills—such as a critical approach to processing knowledge—and an ability to read and write scientific material, which are requirements for successfully studying at university. In order to enhance the development of such skills the teachers' responsibility is to provide the support that creates stimulating learning environments and contexts. Each teacher uses his or her own individual ways of building up the learning environment, for example, in classrooms. Every teaching/learning situation is unique and consequently teachers are challenged to endlessly reflect on their teaching experiences. Furthermore, students must commit themselves to the development of their personal learning skills (Bereiter & Scardamalia, 1996; Cowan, 1998; Bereiter, 2002; Biggs, 2003; Ramsden, 2003).

The quality of student learning depends on the relation between teachers' actions and approaches to teaching, and the quality of the students' approaches to learning. Differences between students' learning have been described through the concepts of surface approach and deep approach. Higher-quality learning outcomes and success in studies are related to a deep approach to learning. Furthermore, students' conceptions of learning have also been shown to be related to the approach that students adapt to learning (Marton & Booth, 1996; N. Entwistle & A. Entwistle, 1997; Marton & Säljö, 1997; Prosser & Trigwell, 1999; Trigwell et al., 1999; Prosser et al., 2003). Before we specify the practical implications resulting from this (see Chapter 'Changing pharmacy teaching', p 6), we will clarify the concepts of surface and deep approaches to learning.

Students who score highly on a scale measuring surface approach try to cope with course requirements by repeating the facts the teacher has presented without developing a profound understanding of the phenomenon. Instead, these students focus on memorising the material to pass the examinations. The consequence is that the students experience difficulties in applying the information to practice, and are not able to develop a self-critical awareness (Bowden & Marton, 1998; Entwistle et al., 2000; Ramsden, 2003; Trigwell & Shale, 2004).

Contrastingly, students who score highly on a scale measuring deep approach study information critically and are interested in the subject matter. They also try to activate their previous knowledge of the matter under study and to fully understand new information. The deep approach to learning is connected with high-quality learning outcomes, better study achievements, perceptions of good teaching, the independence to choose the relevant contents of the subject, responsiveness of the goals, and the development of learning skills (Marton & Säljö, 1997; Prosser & Trigwell, 1999; Trigwell et al., 1999; Entwistle et al., 2000; Ramsden, 2003). In teaching/learning situations, teachers' and students' approaches to teaching and learning are related to each other. The teachers' approach to teaching steers students to adopt either the deep or surface approach to learning. As well, the students' perceptions of their learning environment, constituting teaching actions, study goals, workload, and assessment, are individual and personal. Furthermore, prior experiences affect their approaches to studying. This is also important in understanding the different learning outcomes and variations in the same learning/teaching situations (Prosser & Trigwell, 1999; Trigwell et al., 1999; Kember & Kwan, 2000; Prosser et al., 2003; Richardson, 2005b).

Teachers' approaches to teaching

As regards teaching tasks in the university context a teacher's personality, scholarship, and professional experience have traditionally been highly valued. However, during recent years attention has been increasingly given to teachers' pedagogical skills. Studies show that it is possible to categorise teachers roughly into two main groups according to their approaches to teaching (Marton & Säljö, 1997; Prosser & Trigwell, 1999; Entwistle & Walker, 2000). According to recent results (Trigwell, Lindblom-Ylänne, Ashwin, & Nevgi, submitted) these approaches to teaching indicate the teachers' understanding of teaching as well as their teaching focus.

Traditionally teachers have adopted a teacher-centred approach to teaching (recently, term content-focused, instead of teacher-centred approach has been introduced. See Postareff & Lindblom-Ylänne). This means that they emphasise the content of

teaching as the major goal of their work. The main focus of this kind of teaching is on teachers' actions and the curriculum objectives. In this approach, students are usually given a more passive role and factual knowledge is emphasised. This leads students more easily to adopt the technique of memorising the facts. Furthermore, students' earlier knowledge is not taken into consideration in the learning situation. The purpose of assessment is usually to control students' learning outcomes in a formal way (Biggs, 1996, 2003; Lindblom-Ylänne & Meyer, 1999; Prosser & Trigwell, 1999; Vermunt & Verloop, 1999; Kember & Kwan, 2000; Prosser et al., 2003).

Several studies have shown that the academic discipline is related to university teachers' approaches to teaching. In the "hard" sciences, including pharmacy, teachers are more likely to adopt a teacher-centred approach to teaching (Lueddeke, 2003; Prosser et al., 2003; Lindblom-Ylänne, Trigwell, Nevgi, & Ashwin, 2006). The result is similar to the studies of Finnish pharmacy education, in which the nature of pharmacy education has been characterised by encouraging students' fact-memorising (Nieminen, Lindblom-Ylänne, & Lonka, 2004).

Teachers can help students learn more deeply, not by trying to change students, but by changing their learning environment. This can be achieved by adopting a student-centred approach to teaching (recently term learned-focused, instead of student-centred approach has been used. See Postareff & Lindblom-Ylänne). In this case teachers pay attention to the student's active learning process that includes students' perceptions, activity, and understanding. The teachers' duty is to promote the conceptual change of students' thinking, which includes reasoning, analytic thought, and understanding the relativistic nature of knowledge. The main focus is on the students, their knowledge-building and their involvement in the tasks. The teachers' practices concentrate on activating methods, such as discussion and group tasks, so the interaction between teacher and students is emphasised (Prosser & Trigwell, 1999; Vermunt & Verloop, 1999; Kember & Kwan, 2000; Kember, 2001; Biggs, 2003). A student-centred teacher uses assessment as a tool for learning and activates students to participate in the evaluation of learning outcomes (Birenbaum, 2003; Segers et al., 2003b).

In practice, teachers' perceptions of their teaching situation (Figure 1) constitute five main aspects, presented here in Table I, that affect their teaching approaches (Prosser & Trigwell, 1999; Trigwell & Shale, 2004).

One important factor in identifying teachers with the different approaches is a positive attitude and interest in their subject. A teachers' positive attitude more likely leads to a student-centred approach to teaching (Trigwell et al., submitted). Furthermore, Prosser and Trigwell (1999) have found that teachers using a student-centred approach are more satisfied with their teaching. The use of a student-centred approach is also more likely to lead students to adopt the deep approach to learning. In a student-centred approach the focus is on students thinking and being engaged instead of the teacher's own actions. In practice this is seen as activating teaching methods which involve self-directed learning, discussions about problems, talking about conceptual change, and debating about the alternatives.

Students' thinking and reasoning

The main target in higher education is giving students the possibility to engage in thinking and reasoning such that they become familiar with their disciplines. Student-centred teachers help their students to create learning situations which facilitate the student's engagement in learning tasks and problem-solving. The development of academic thinking and reasoning skills, including conceptual change, are parts of the student's personal epistemology. Learning is an individual personal process that has been described as a system including several essential elements, such as metacognition and epistemological beliefs. The students' attitudes and approaches to learning reflect their development of personal epistemology. The main concepts of personal epistemology are presented in this chapter (Baxter Magolda, 1999; Entwistle & Walker, 2000; Bendixen, 2002; Hofer, 2002; King & Kitchener, 2002; Kuhn & Weinstock, 2002; Pintrich, 2002; Schommer-Aikins, 2002; Hofer, 2004a).

Personal epistemology

Epistemological beliefs play a central role in learning because they affect both teachers' teaching strategies and students' studying (Entwistle et al., 2000). Personal epistemology concerns aspects of an individual's

Table I. Teachers' perceptions of teaching environment.

(1) Autonomy	Teacher decides what material to teach and the teaching strategies
(2) Class size	Reasonable amount of students in a class enables interaction and active pedagogical implications for the group
(3) Students' thinking and reasoning skills	Enables the understanding of the subject matter despite the variation of the individual students' learning abilities
(4) Feedback	Especially from academic scholars, that teaching is valued in the department
(5) Teaching workload	Workload is reasonable and in balance with other academic tasks

cognitions as regards the nature of knowledge and the process of knowing. Personal epistemology includes cognitions and beliefs about the certainty of knowledge (objectivist versus complex), the simplicity of knowledge, the source of knowledge (external authorities versus personal voice), and justifications for knowing (criteria for making knowledge claims, use of evidence and use of reasoning). Beliefs about knowledge and other aspects such as learning, instruction, and intelligence are interrelated and in some cases intimately bound together (Pintrich, 2002; Hofer, 2004b). Thus, when developing instruction it is important to understand the effect of epistemologies. The main focus in academic teaching and learning practices should be on enhancing the development of a student's individual ability, to construct a complex and versatile conception of knowledge. This objective is attained with good learning outcomes by the use of the student-centred and deep-level approaches (Trigwell et al., 1999; Entwistle et al., 2000; Kember, 2001; Trigwell & Shale, 2004).

Several scholars have observed that personal epistemologies are metacognitive processes that affect everyday learning (Cowan, 1998; Bendixen & Rule, 2004; Hofer, 2004a; Louca, Elby, Hammer, & Kagey, 2004). Metacognition, which means thinking about thinking and being aware of one's own cognitive processes, plays a central role in lifelong learning and continuous individual development. Furthermore, it also consists of the idea of the skills used to assess and reflect on one's own learning, action thinking, and knowledge. This leads us to define the development of personal epistemology as a dynamic process that interacts with context, effect, and environment. As Bendixen and Rule (2004) summarise, metacognition is connected with this by giving it important implications regarding the effectiveness and longevity of personal epistemology development. In pedagogical situations personal epistemology as a metacognitive process allows for an integrated format that includes the dynamic interaction between teacher, task, student and learning environments (Bendixen & Rule, 2004; Hofer, 2004a).

A student's personal epistemology usually develops when the studies proceed. Recent research indicates that personal epistemologies develop from a dualistic, objectivist view of knowledge to a more subjective, relativistic stance, and ultimately into a contextual, constructivist perspective of knowing (Hofer, 2002). The dualistic conception of knowledge could be described as a novice-like black-and-white attitude. A sophisticated perspective or stance toward knowledge and knowing is correlated with deep-level cognitive strategy use, reading comprehension, and academic performance which in turn correlate the engagement with thinking and reasoning (Kember, 2001; Qian & Pan, 2002). It is the coordination of the subjective and objective dimensions of knowing that is the essence of the epistemological beliefs' development.

The development of personal epistemology is a lengthy process which demands active work and reflection on one's thoughts. In practice, the teacher's awareness of the process and development of personal epistemology are needed to support students' personal goals and guide self-regulatory cognition and behaviour. Furthermore, these personal goals and self-regulatory strategies mediate the relations between the personal epistemologies and academic achievements (Entwistle & Walker, 2000; Kember, 2001; Pintrich, 2002).

Epistemological beliefs in pharmacy

A follow-up study about pharmacy students' learning and the development of their epistemological beliefs was conducted in Finland in 1994–1997 (Nieminen et al., 2004). The study indicated that pharmacy students' epistemological thinking was strongly dualistic and that it developed only slightly towards more relativistic thinking. Furthermore, previous studies indicate that pharmacists experience problems in reflective thinking and in applying their theoretical knowledge to practice (Vainio, Pennanen, Tuomainen, & Enlund, 1998; Närhi, Vainio, Ahonen, Airaksinen, & Enlund, 1999; Sihvo, Ahonen, Mikander, & Hemminki, 2000; Sihvo, Klaukka, Martikainen, & Hemminki, 2000; Vainio, Airaksinen, Hyykky, & Enlund, 2002; Kansanaho, Pietilä, & Airaksinen, 2003; Attewell, Blenkinsopp, & Black, 2005). This in turn may reflect poorly developed epistemological thinking (King & Kitchener, 2002). However, acting efficiently in work, and also in pharmacy, demands that domain-specific knowledge is structurally organised into large, coherent, and retrievable units. The main factors that are associated with competent performance include cognitive skills, attitudes, values, and affective attributes, along with technical or psycho-motor skills as well as interpersonal and communication skills (Hager & Gonczi, 1996; Hager & Smith, 2004). Especially in ill-structured problems faced at work, it is necessary that the knowledge be well-structured and useful. Furthermore, reflective skills and reflective thinking are tools and basic requirements in professional development. Dualistic and objectivist knowledge is of little use in helping students achieve expertise in pharmacy. The development of pharmacy expertise requires that knowledge and skills gradually become integrated (Cowan, 1998; Hativa & Goodyear, 2002b; Boshuizen, Bromme, & Gruber, 2004).

For this reason it is necessary to pay attention to pharmacy education and how it fosters students' epistemological thinking. Contextual and domain-specific epistemological beliefs influence teaching/learning activities and learning achievements. The domain-specific conception and beliefs concerning knowledge affect teachers' approaches to teaching and

have practical implications. Teachers are more likely to relate their teaching approaches to the disciplinary environment (Ramsden, 1997; Prosser & Trigwell, 1999; Entwistle & Walker, 2000; Entwistle et al., 2000; Hofer, 2000; Samuelowicz & Bain, 2001; Tynjälä, 2001; Biggs, 2003; Norton, Richardson, Hartley, Newstead, & Mayes, 2005). In the sciences, it is common to seek knowledge that is exact and certain (Paulsen & Wells, 1998; Hofer, 2000; Neumann & Becher, 2002). As Martin et al. (2000) have stated, teachers' intentions are connected with their teaching practices. The analysis shows the variation in teachers' intentions (a) to transfer information to students and (b) to chance students' conceptions and understanding of the discipline. The main finding in the study emphasised that the teachers' intentions and learning objectives and their approach to teaching were interconnected. This focussed attention not only on improving the quality of teachers' skills, and strategies, and approaches to teaching, but also to finding out what intentions and learning objectives—-for example, in the nature of knowledge and epistemological beliefs—teachers have for their students. Teachers' intentions regarding objectives determine the teaching quality and learning outcomes (Martin et al., 2000; Norton et al., 2005; Vermunt, 2005).

In pharmacy this interconnection means that the teachers' objective of exact and certain knowledge may easily lead to a teacher-centred approach and encourages students to use the surface approach to learning. Lueddeke (2003) has confirmed that teachers of natural sciences are more information-transmission-oriented and teacher-centred compared to teachers of behavioural sciences. Furthermore, it is more likely that students' epistemological beliefs stay dualistic (Entwistle & Walker, 2000; Entwistle et al., 2000).

Changing pharmacy teaching

The quality of teaching already improves with slight changes. The main point is to enhance the interaction between teacher and students or among students in the class. This does not require a wide range of new and time-consuming teaching methods or practices; it is more important that the teacher becomes aware of his or her own approach to teaching, and when it needs to be improved. This means a change in the teacher's conceptions and ideas of teaching, and which henceforth becomes a continuous learning process (Cowan, 1998; Kember & Kwan, 2000; Trigwell, 2001; Ramsden, 2003; Lindblom-Ylänne et al., 2006).

When the aim is to develop pharmacy teaching, it is important to notice that students modify their approaches to learning on the basis of the challenges presented by the domain-specific learning environment. In an ideal learning environment teachers challenge students to develop their thinking and learning skills as well as encourage students to adopt the deep approach to learning. Furthermore, the most important challenge for higher education in pharmacy is to support the students' development of their personal epistemology. For this reason, the focus of learning objectives in pharmacy education should be directed away from knowledge transmission and towards the justifications for knowing, through criteria for making knowledge claims, use of evidence, and use of reasoning. This is significant in order to release inert knowledge and to improve skills for applying theoretical knowledge in practical situations, which is necessary for becoming a professional expert in pharmacy. In the following chapter this aspect is presented in connection with teaching practices (Eraut, 1994; Ramsden, 1997; Gordon & Debus, 2002; Neumann & Becher, 2002; Biggs, 2003; Ramsden, 2003; Boshuizen et al., 2004).

Constructive alignment and motivation

Approaches to learning describe students' learning activities, and not their personalities or individual characteristics. Instead, they describe the way students settle into the teaching/learning environment. According to Biggs (2003), when teachers encourage students' deep approach to learning, the expected learning outcomes, as conceptual changes, are possible. According to Biggs (2003) this requires: (1) shared learning objectives, (2) motivation to learn, (3) students being able to perform tasks independently, and (4) collaborative working in dialogue with peers and teachers. These four points, connected to the concepts of surface and deep approaches to learning, are the fundamental starting point for the design of teaching. These aspects are presented below.

Biggs (2003) uses the concept of constructive alignment, which includes the curriculum, teaching methods, assessment, climate of collaborative work, and the discipline climate of the faculty. The main principle is that good teaching and deep-level learning must be balanced in the teaching/learning system, and that constructive alignment design encourages student full engagement in learning. The shared and negotiated learning objectives of students and teachers are the starting point. The goal of expertise and professional skill is supposed to be the source of students' motivation in studying pharmacy in an academic context. The motivation to achieve the learning objectives is traditionally linked with students' inner enthusiasm for the subject and not the teachers' actions. Biggs (2003) turns this statement upside down and reminds us that students engage the tasks if teachers increase the students' appetite for the subject. This will happen if students consider the learning task to be meaningful, important, and of

value to them. They also need to feel confident that they will succeed and that they have the ability to complete the course. The responsibility of students' motivation is on the teachers—good teaching awakens motivation (Kember & Kwan, 2000; Ramsden, 2003).

The teacher's attitude interacts remarkably with student motivation to participate and learn. Accompanied by the student-centred approach to teaching, the students' deep approach to learning arises from the need to engage the task appropriately and meaningfully. Furthermore, students try to apply the most appropriate cognitive activities for dealing with it. When students consider tasks important they try to focus on understanding. This often naturally leads students to learn the details, as well as making sure they understand the meaning, main themes, and applications (Biggs, 2003; Ramsden, 2003). This kind of attitude is related to the deep approach to learning and motivates students to settle the aims of maximising their understanding (Lonka & Lindblom-Ylänne, 1996; Kember & Kwan, 2000; Kember, 2001). Furthermore, students become more interested in studies which lead them to real benefits, such as intrinsic motivation, professional skills for working life, and personal ownership of learning (Boekaerts & Minnaert, 2003).

Teaching methods do not define whether a teacher has adopted a student- or teacher-centred approach to teaching. The focus is on how the methods are applied. For example, it is possible to organise mass lectures by applying a student-centred approach to teaching, and students' may have an excellent learning experience. An interactive lecturer, for example, can create a discussion of the fundamental questions of the discipline, and the current problems, and maintain this even in a larger group. Other activating tasks can be, at their simplest, small group or peer discussions. Activating writing tasks, such as short essays or exams, can be arranged to help students become conscious of their previous knowledge of the matter. It is also valuable for a teacher to become aware of students' prior knowledge. The wide range of methods offer teachers and students the possibility to interact and discuss essential problems, debate different alternatives and opposite options, write about conceptual change (e.g. via dialogue diary), have dialogues and consider the important questions (Prosser & Trigwell, 1999; Trigwell, 2001; Gordon & Debus, 2002; Biggs, 2003; Prosser et al., 2003; Ramsden, 2003). Thus, the main point in teaching is the teacher's conception of good teaching and learning (Entwistle & Walker, 2000; Kember & Kwan, 2000; Martin et al., 2000).

A teacher should also encourage students towards self-directed learning in multiple ways. For example, the brief moments of pondering over an issue either individually or in small groups, debates, or collaborative teaching, do not require much extra work but bring considerable surplus value to the teaching. They increase the students' responsibility for their active role and quality of learning. It is possible to deepen this through individual learning diaries as a tool for students' self-reflection (Prosser & Trigwell, 1999; Trigwell, 2001; Biggs, 2003; Prosser et al., 2003). The improvement of teaching to support students' self-directed learning skills in pharmacy should also include a professional approach. This relates the academic theoretical knowledge to the challenges in real working life (Gordon & Debus, 2002; Neumann & Becher, 2002; Boshuizen et al., 2004). In pharmacy, these viewpoints are easily connected. Examples of real pharmacy practices give students opportunities to understand the significance and meaning of the theoretical aspects. Furthermore, as students see and understand the link between practice and theory, they are motivated to study, and learn to respect the significance of theoretical pharmacy studies (Katajavuori, Lindblom-Ylänne, & Hirvonen, 2006). Working life requires practical skills and situational knowledge, professional experience, and judgement (Eraut, 1994; Hativa & Goodyear, 2002b). It is a challenge to realise that practical and theoretical knowledge linked together supports the use and applicability of both in pharmacy education (Benner, Tanner, & Chesla, 1996). This would be more apparent if teachers included them in the learning objectives and assessment right from the beginning of pharmacy studies.

Assessment

Assessment methods have a major role in education because they strongly guide student learning. According to N. Entwistle and A. Entwistle (1997), the traditional university accreditation and assessment, which focuses on trivial and irrelevant knowledge, at least from the students' point of view, promotes the surface approach to learning. These kinds of tests are "high stakes", and are connected to a type of teaching which emphasises the transmission of knowledge and a teacher-centred approach (Ramsden, 1997; Ramsden, 2003; Segers, Dochy, & Cascallar, 2003a; Vermunt, 2005). Furthermore, such methods tend to measure the remembering of details instead of profound understanding (Brown, 1997). For high-quality learning outcomes and enhancement of the deep approach to learning, assessment tasks should be aligned to a student-centred approach to teaching as well as to the formal learning objectives in curricula (Gordon & Debus, 2002; Biggs, 2003; Ramsden, 2003).

Inappropriate assessment tasks allow students to achieve a good mark on the basis of memorising facts. Fact-learning and memorisation becomes a surface approach when it is used instead of profound understanding (Biggs, 2003; Ramsden, 2003). According to recent studies (Kember & Kwan, 2000;

Gordon & Debus, 2002; Neumann & Becher, 2002; Segers et al., 2003a), traditional assessment favours students using the surface approach. At the same time, students who prefer the deep approach to learning, including active and creative learning assessment, feel lower self-esteem with traditional methods. Furthermore, tests reinforce the low self-image of lower-achieving students and favour only the best students. These experiences decrease the motivation of low-achievers and increase the differentiation among students. Consequently, it is important to change the traditional forms of exams and testing into other modes of assessment (Segers et al., 2003a).

To improve the quality of professionally relevant knowledge, and to encourage an understanding of the learning objectives, assessment must be aligned and integrated in teaching design to lead to pertinent learning outcomes (Kember & Kwan, 2000; Segers et al., 2003a,b; Struyven, Dochy, & Janssens, 2003). In an aligned teaching design, students are responsible for and active in the assessment of their achievements together with their teachers. In practice, the assessment tasks, criteria, and scores can be shared and negotiated between teachers and students. Learners have shown a positive attitude towards alternative methods as long as the assessment has had a positive effect on their learning and students have felt it to be fair (Segers et al., 2003a,b; Struyven et al., 2003). According to Dochy (2005), the new modes of assessment include: (1) students construction of knowledge instead of memorising, (2) knowledge connected to authentic situations, (3) students showing the ability to have multiple perspectives and context sensitivity with respect to learning tasks, (4) the student's active role, and (5) the integration of assessment in the learning process. These criteria are in line with the principle that students are responsible for their own learning and that the learning is a social process.

Recent studies have shown that the most effective way to achieve a change in assessment is to commit students to self-reflection and peer-assessment as well as to increase the teachers' qualitative assessment (Segers et al., 2003a,b; Topping, 2003). This can be done in small steps by selecting a few new modes of assessment and including them in the teaching design. Possible modes of assessment include, for example, observations, overall tests, portfolio-assessment, co-assessment, and self-assessment. Assessment tasks are time-consuming, but the results of their positive effect can be shared among students and teachers to motivate them further. As Birenbaum (2003, p. 29) summarises, "assessment for learning improves learning".

Segers et al. (2003a) have studied the effects of assessment tasks integrated into the learning process by comparing students taking part in an ordinary course with those in a similar test course including six integrated assessment tasks. The test group had better results in the final exam in every topic and especially for questions which related to the topics treated in the assessment tasks. Furthermore, the feedback from the test group students was positive for the assessment tasks, as they steered students towards working more intensively, independently, and systematically in the course. According to the students, the learning process, including assessment tasks, improved their capability in problem-solving, critical thinking and reasoning. Naturally, the teachers were also pleased about the learning outcomes and their students' commitment to the deep approach to learning (Segers et al., 2003a).

Constructive and destructive friction

Vermunt and Verloop (1999) have analysed frictions between learning and teaching that easily appear when changes, for example new teaching methods, are put into practice. Usually the developing of teaching has a positive effect on students. They appreciate teachers who are more involved in their teaching. Furthermore, students may become interested in developing their own learning skills through teacher's assistance which promotes and strengthens their motivation to study. In this way, constructive friction is created between students and the teacher. The student is urged to develop his skills, and new activity is required. The alternative to these positive effects is the unsatisfied students' resistance to change and reforms. They experience the activating teaching practices, for example the learning diary, as too laborious compared to the traditional passive lecture format or individual reading tasks. Students may get frustrated from the fact that they are considered to be. The teacher should discuss the new teaching approach and justify the change. The students might accept the reforms with the teacher's guidance and advice. If the students' resistance is handled with arrogance, destructive friction is easily created between students and the learning environment. This prevents students from using their skills and their readiness to learn (Lindblom-Ylänne & Lonka, 1999; Vermunt & Verloop, 1999; Lindblom-Ylänne & Lonka, 2000a,b; Lindblom-Ylänne, 2003; Vermunt, 2005).

Developing teaching and implementing new practices may also cause constructive and destructive friction among teachers. Teachers with heavy workloads or longer work histories sometimes even find it impossible to change their methods according to the new demands of high-quality teaching. However, teachers' investments in a student-centred approach can be rewarding when students become excited and motivated, and show a desire to learn, to understand, and to develop their own knowledge. The frictions related to the development of teaching are thus a natural and unavoidable part of higher education.

Therefore, it is indeed important to encourage pharmacy teachers to develop their teaching. Likewise, pharmacy students need support and guidance in developing study skills especially during the first years of their studies when self-regulation skills are typically under developed (Lindblom-Ylänne & Lonka, 1999; Vermunt & Verloop, 1999; Lindblom-Ylänne & Lonka, 2000a,b; Lindblom-Ylänne, 2003; Martin & Lueckenhausen, 2005; Vermunt, 2005).

According to Vermunt and Verloop (1999), an ideal learning environment continuously creates different constructive frictions. It is still a fact that short destructive frictions are general, and an unavoidable part of learning. It is a challenge for teachers to take into account destructive frictions, and avoid them. Furthermore, teachers should promote congruence and constructive frictions that improve student learning. The student-centred approach to teaching makes it possible for students to study in an individual way. However, it can be used to regulate constructive frictions. The students' ability to manage destructive frictions is essential for good learning atmospheres and results. An ideal learning environment seems to contain constructive friction and in it students are continuously challenged to develop their skill and knowledge (Lindblom-Ylänne & Lonka, 1999; Vermunt & Verloop, 1999; Lindblom-Ylänne & Lonka, 2000a,b; Lindblom-Ylänne, 2003; Vermunt, 2005).

Conclusion

The quality of higher education is a current issue in Europe. Due to the Bologna process the harmonisation of qualifications and internationalisation of curricula are proceeding in universities as well as creating the quality assurance systems for higher education. In this process, enhancing the quality of learning and teaching should be the main issue, not the systems or the content of the curriculum in itself.

Pharmacy education should give pharmacy students good learning skills (including metacognitive, reflective and self-regulative). These skills need to be supported during pharmacy education in order to produce new pharmacy experts who are capable of continuous development and lifelong learning in working life (Boshuizen et al., 2004; Hager, 2004).

The development of learning skills is dependent on the multidimensional nature of the learning process (Figure 1). We believe that a proper understanding of the nature of this process can provide tools for improving pharmacy education. In a good learning environment the students' learning is enhanced systematically, and teaching and assessment methods are in line in order to support deep-level learning (Biggs, 2003). This challenges pharmacy educators to reflect on their teaching, and furthermore, on their attitudes towards teaching and learning (Cowan, 1998; Hativa & Goodyear, 2002b; Ramsden, 2003).

The development of pharmacy teaching may also increase frictions among teachers and temporarily overload them. On the other hand, this may also reward pharmacy teachers with motivated pharmacy students who are willing to learn properly and develop better cognitive skills. Because the frictions are a natural part of improving pharmacy teaching (Vermunt & Verloop, 1999) it is important to offer pedagogical support for teachers.

In Finland, the University of Helsinki has invested in offering pedagogical training to teachers. The Center for Research and Development of Higher Education conducts research on teaching and learning in higher education and further, offers pedagogical training (Lindblom-Ylänne & Hämäläinen, 2004). During this training the development of teachers' pedagogical thinking is supported in addition to introducing the teachers to the learning process and new teaching methods (Postareff, Lindblom-Ylänne, & Nevgi, in press).

Furthermore, good and effective learning skills are not developed by chance. For this reason it is important also to take into account the students' learning process and to support it during pharmacy education, especially of the beginning of studies. For example, an orientation course in which learning and teaching would be discussed with the students at the same time as discipline-related studies could be one tool for enhancing students' learning.

Enhancing the quality of teaching and learning in the field of pharmacy is a challenging aim. To achieve it we need more research, particularly into pharmacy teachers' conceptions of learning and teaching, students' learning, and students' epistemological beliefs. This kind of research would provide the tools for improving the quality of pharmacy education.

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