Analysing the concept of context in medical education

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BACKGROUND There is increasing interest in the role of context in medical education, with the conjecture that learning in a clinical context may be helpful for later recall of knowledge. Although this may be true in a general sense, at a closer look it appears that the notion of context is not well substantiated in the medical education literature and that the concept is not clearly defined. Effects of context on learning appear to depend on type of learning task, the relationship or interaction between the context and the learning material, and motivational features of the context. Context is often implicitly regarded as a uniform concept but conceptual analysis shows that a distinction can be made in several dimensions.

RESULTS In this paper, we identify 3 different dimensions of context: a physical dimension, representing the environmental characteristics; a semantic dimension, reflecting how well the context contributes to the learning task, and a commitment dimension, representing the amount of commitment (in terms of motivation and responsibility) that is generated by the context. On these dimensions, context can be ordered from reduced (providing few cues, little meaning, little commitment) to enriched (many cues, much meaning, high commitment).

CONCLUSION This model can serve a dual purpose: first, to disentangle several aspects of educational contexts (e.g. as high in meaning but low in commitment), and second, to provide a theoretical framework to generate research on the influence of different contexts in education on students' learning.

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KEYWORDS education, medical/ *methods; *learning; *models, educational; *clinical competence; cognition; motivation.

*Medical Education 2005; **39**: 1243–1249*
doi:10.1111/j.1365-2929.2005.02338.x

INTRODUCTION

A critical feature in medical education is the transition from the context of classroom learning to that of the clinical setting, where students are faced with real patients and must learn to conform to the requirements of the hospital as an institution. This transition is, for many students, so far-reaching that it has been aptly called a 'shock of practice'.[1] At least partly, the shock of practice is emotional: students experience feelings of insecurity, embarrassment and fatigue.[2] However, the transition also involves problems of a cognitive nature: students report a knowledge deficit and are unable to apply their knowledge in practice.[2] Even in a problem-based learning (PBL) curriculum, a curricular format which explicitly claims to equip students with knowledge embedded in an appropriate context,[3–5] the shock of practice appears to occur.[2] One possible reason why PBL has not as yet demonstrated better preparation of students for future medical practice is that the concept of (clinical) context itself is not appropriately conceptualised and delineated.

Nevertheless, the notion that medical education should be integrated, or more specifically that the basic sciences should be presented in a clinical context, has pervaded the literature on medical education for the last 25 years.[4,6] Therefore, in this paper, we will attempt to analyse the concept of context, first in a general sense, and subsequently as it is conceived in medical education. Next, we will develop a model we think might be helpful in both

Overview

What is already known on this subject

Learning in context is supposed to facilitate students' recall. This 'context' is regarded in medical education as a uniform concept.

What this study adds

In this paper, we identify 3 different dimensions of context: a physical dimension, representing the environmental characteristics; a semantic dimension, pertaining to the internal conceptual framework related to the learning task, and a commitment dimension, representing the amount of experienced motivation and responsibility for a learning task. Each of these dimensions can be ordered from reduced to enriched contexts. By manipulating the different context dimensions, we may gain insight into the learning process.

Suggestions for further research

Future research might concentrate on finding out how different contexts in education influence students' learning.

conceptualising and analysing the influence of context on learning in medical education. This model is based upon a paper by Oztürk and Aamodt.[7] Finally, we will discuss the advantages and disadvantages of this model.

LEARNING IN CONTEXT

In the most simple and neutral approach, context is just the setting in which a target (e.g. the learning material) is presented or found.[8,9] In an educational sense, the context can be conceived as the environment in which students are taught, often a classroom. However, usually a much more extended concept of context is used. For example, to-be-learned material can be presented in a problem-solving context. Moreover, an educational learning environment is often designed to promote future application of the knowledge presented. In this regard, context also includes the current knowledge of the learner.[10]

EVIDENCE FOR THE ROLE OF CONTEXT IN LEARNING

An abundance of studies has revealed various effects of context on learning. We will discuss some general effects of context reported in the literature.

Same-context advantage

The existence of a same-context advantage for memory recall has been well documented.[11,12] In general, the context in these studies is defined as the physical surroundings. Basically, the design is quite simple: participants in both an experimental and a control group are presented with to-be-learned material (usually a list of words or nonsense syllables) in a particular setting. Subsequently, a memory test is administered to both groups; the experimental group is tested in the same setting in which the learning took place, whereas the control group is moved to a different setting. The positive and statistically significant difference in recall between the experimental and control group is called the 'same-context advantage'. The finding of a same-context advantage attests to the powerful role of cues present in the environment during both learning and memory testing which are thought to be encoded in memory along with the to-be-remembered materials. When the cues reappear in the environment in which memory is tested, they facilitate memory performance for the learned materials.[13] Probably, the effect of physical cues in the environment on encoding is strongest when the cognitive effort is relatively small, that is, when the material to be learned requires little conceptual thinking (e.g. a list of isolated words). This may explain why a large same-context effect was found in the Godden and Baddeley study,[14] where divers were asked to remember lists of words underwater or on land, whereas usually in classroom studies employing regular educational material, only minor effects of testing in the same versus a different room have been reported.[15] Therefore, the same-context advantage may have limited applicability in educational contexts.

Independent and interactive contexts

The same-context advantage will be clearest if the context and the to-be-learned material are unrelated, such as learning a list of words while being underwater. In such a condition – which usually only occurs in an experimental set-up – the context is called 'independent'.[16] In settings where learning is supposed to occur, such as classrooms, the

context is often explicitly designed to facilitate encoding of to-be-learned materials. When context features can be meaningful (e.g. a blind map is a meaningful tool when learning the names of the capital cities of all European countries), the context is called 'interactive'.[16] Again, the effect of an interactive context extends to the cognitive environment and includes not only the meaning of the cues physically present in the learning environment, but also the learner's task, whether self-imposed or externally provided.

The learner's internal context

In most real-life learning environments, what is learned has meaning for the learner, and is interpreted in terms of his or her accumulated prior knowledge and experiences. This is what we mean by the learner's 'internal' context. If specific experiences are deliberately provided in an educational setting (e.g. a videotaped patient case in medical education), they are intended to be encoded in memory representations of generalised event sequences, or scripts.[17] Scripts stored in memory are part of the learner's internal context; they are used to interpret specific experiences in terms of prior knowledge, where relevant aspects of the experience are encoded, along with irrelevant details that do not need to be remembered. What is relevant in such an experience will be determined by the learner's internal context.

CONTEXT AND MOTIVATION

The willingness to invest energy in learning is conceived in terms of the learner's motivation. Contextual factors could contribute by engendering commitment in the learner: the context engages the learner in the learning task. It is important to note that commitment derived from context may influence the learning process independently of cognitive and task factors.[18] An example would be the difference between learning for a practice examination versus learning for a real examination. Cognitively, these tasks are highly similar, but the latter generates a higher level of commitment in the student than the former. Conversely, motivation may also exert an influence on the cognitive aspects of learning; for example, if learners adopt a deep approach to learning as opposed to a surface approach,[19] increased motivation may change the nature of the (self-imposed) learning task. In practice, cognitive and motivational driving forces in the context will often be confounded.

CONTEXT IN MEDICAL EDUCATION

During the last decade, the role of context has been increasingly discussed in medical education.[4,20] The phrase 'learning in context' has often been used but has not always been clearly defined. In addition, the same-context advantage is frequently used to support claims about the effectiveness of a PBL approach.[4] However, context, as conceptualised in studies in medical education, is more encompassing than in the original studies, where it referred to the physical environment only.

At a cognitive level, context is often used to characterise the relationship between the basic and the clinical sciences, and between both of these and clinical practice. Over the past decades, the rationale behind PBL has evolved from learning problem-solving skills to learning the basic sciences in a clinical context.[4,10] Although there is limited evidence that students from PBL curricula have their basic science knowledge more readily available than students from conventional curricula,[21,22] there is also evidence that application of biomedical knowledge to a clinical case is beset with difficulties.[23] In a sense, biomedical and clinical knowledge may be considered as belonging to 'two different worlds'[24] and it may be questioned whether learning the basic sciences in the context of clinical cases actually has a cognitive advantage, or, in other words, whether the context of a clinical case facilitates learning of the underlying biomedical knowledge. As yet, the alternative hypothesis that the clinical context increases commitment to learn biomedical knowledge because it increases the willingness to invest more effort in the learning task cannot be refuted.

Another approach to context in medical education refers to the clinical learning environment at a more macroscopic level. There is an increasing tendency among medical educators to consider the clinical environment the most appropriate learning context for (advanced) medical students.[25] As an educational approach that values the real-life context, situated learning was introduced in the late 1980s[26] and has since generated interest among medical educators.[27] Advocates of this approach emphasise the apprenticeship as the primary learning context, in which the learner is engaged in authentic tasks.[26] These are tasks that present most of the cognitive demands the learner would encounter in the real world, such as socially shared mental work.[28] In medical education, the clinical ward presumably offers such authentic tasks because it is an enriched environment in which

there is much to learn. The problem with very enriched contexts is that the quality of the learning environment is difficult to control, because such contexts are not primarily designed to meet educational demands.[29] In other words, these contexts may be considered physically enriched, but not semantically; therefore, no same-context advantage will be expected for such contexts, at least not for meaningful learning materials, because the cues available in these contexts may be entirely unrelated to the material to be learned. Therefore, we would argue that there is a need for an analytical model of learning in context that can be applied to medical education.

DEVELOPMENT OF A DIMENSIONAL CONTEXT MODEL

As our aim is to develop a model that can be applied to learning tasks in educational environments, we decided to categorise these types of context into 3 contextual dimensions of learning. We opted for dimensions, rather than types or categories, because we think they represent a continuum, ranging from very reduced (e.g. a simple task, learning materials with little meaning) to enriched (e.g. a complex, real-life task) and together establish what can be called a 'context'. Although the model has been developed for medical education, it can be adapted to other domains in which physical, semantic/cognitive and commitment aspects of learning contexts are involved. Table 1 gives an overview of this dimensional context model.

Table 1 Dimensional context model with examples from medial education

	Reduced context	→ → → → →	**Enriched context**
Physical dimension	Learning in a study cubicle	Learning in a skills lab	Learning in the clinical ward
Semantic/cognitive dimension	Learning facts with no connection to clinical practice	Reading and understanding a logically coherent basic science text	Constructing a pathophysiological explanation of a clinical case
Commitment/affective dimension	Reading medical news in a newspaper	Reading text to report in a peer group	Learning with responsibility for patient care

The physical dimension of context

This dimension pertains to the environment in terms of the physical surroundings of the learner. All the elements that are part of this dimension are in principle independent of the learning task. A same-context advantage will be predicted for any physical context, because the cues are arbitrarily linked with the to-be-learned material. As research suggests that the same-context advantage is largely limited to rather simple learning tasks,[11] such as lists of isolated words, our hypothesis would be that only a small same-context advantage of the physical dimension would be found for a complex task, such as learning the physiology of the cardiac system.

The semantic or cognitive dimension of context

The semantic or cognitive dimension is where the knowledge of the learner and the information in the

context, which can be used to perform the learning task, connect. We do not refer to 'semantic' only in a linguistic sense; we use it more broadly and it therefore also represents the prior knowledge of the learner. When a task can be construed as simple, it can be positioned at the reduced end. At the enriched end, a very complex task can be found, such as understanding a pathophysiological text and using the information in the text to construct an explanation of a clinical case.[24] Educators and teachers often manipulate tasks on the semantic dimension by providing additional information, splitting up tasks into smaller parts, etc. In this way, tasks can be shifted towards the more reduced end of the semantic dimension. Conversely, tasks can also be shifted towards the more enriched end of this dimension, by, for example, introducing elements of knowledge application, rather than just memorisation.

The commitment dimension of context

This dimension covers all aspects of context that affect a learner's motivation for a learning task, including emotional involvement and the willingness to invest effort. We call this dimension 'commitment' to emphasise that we conceive of it as context-dependent and possibly fleeting, whereas motivation may be a more longstanding characteristic associated with a particular student's personality. Students' commitment increases when, for example, a teacher makes a strong appeal to them. In addition, commitment may be generated by a particular learning task, whether self-imposed or externally imposed. In our view, the commitment dimension is limited to the direct influence of context on students' motivation; this is in line with Ausubel, who considers motivational and attitudinal variables as 'energisers', not directly involved in the cognitive interactional process.[18] The most straightforward effect of increased commitment would stimulate students to spend time on the learning task. It should be noted that commitment can also exert an indirect influence by changing the learning task, for example, when increased commitment induces students to adopt a deep rather than a surface approach to learning. In this case, an increase in commitment is associated with a shift of the learning task towards the more enriched end of the cognitive dimension.

Contexts at the reduced end of the commitment dimension – like learning from reading a medical article in a newspaper or magazine – will generate little commitment. At the enriched end, contexts generate high commitment: for example, learning with responsibility for patient care. Although in general a high level of commitment might be considered favourable, this may not always be the case: for instance, when the consequences of an examination are high (as compared to in a non-consequential examination), students' test anxiety also increases, hence leading to lower performance.[30] It is not unlikely that, with respect to learning, there is an optimum level of commitment, in line with the classic Yerkes–Dodson law. According to this law, an inverted-U relationship holds between arousal and task performance, with performance being optimal at intermediate levels of arousal.[31,32] The idea of an optimum level of commitment would be in line with Gordon et al.'s and Ten Cate et al.'s recommendations that students should be given graded responsibility for patient care.[27,33]

CONCLUSION

In this paper, we have presented a framework for analysing the effects of context based on 3 dimensions. We distinguished a physical dimension, a semantic dimension and a commitment dimension. Any learning context can be assigned a particular position on each of the 3 dimensions, ranging from reduced to enriched, basically independent of the position on the other 2 dimensions. The model may help in both selecting appropriate contexts for training and in researching the significance of context for learning in general.

We think it is useful to consider any learning context as a particular combination of the physical, semantic and commitment dimensions. Thus, cultural and ethical aspects emphasised by the particular medical school or hospital are reflected in the model by the nature of the tasks, electives and group discussions. This also offers opportunities for medical schools to evaluate whether they actually practise what they preach. Thus, whether the institution provides teachers who model the appropriate commitment to ethical aspects of their practice could be investigated.

The clinic is often recommended as the optimum environment for learning, because knowledge learned in a clinical context is thought to be more accessible when it is applied in the future in that context. However, Koens *et al.*[34] found that medical clerks tended to recall more information about a clinical case if that case had been learned in a clinical context, regardless of the recall context. Although this finding has still to be validated and substantiated by further research,[35] it suggests that

at least some information is indeed better learned in a clinical context, but this may have nothing to do with its future application (or recall) in that context.

The role of the clinical context in learning the basic sciences is an important aspect of the semantic dimension. Proponents of PBL suggest that presenting basic sciences in a clinical context leads to better retention.[4] It may be disputed whether this depends on cognitive or commitment factors. The model we described distinguishes between these possibilities and therefore offers suggestions for research. In addition, it has also been suggested that PBL students are better able to apply their basic science knowledge to solving clinical problems. This may be true, but it is irrelevant if the application of basic science knowledge is seldom necessary in clinical practice. This may be exemplified by clinicians who consider basic science knowledge as to be less core knowledge than clinical knowledge,[36,37] or who perhaps find it difficult to recognise or articulate how it is used.

We definitely do not want to deny that presenting basic science information in the context of clinical problems could have beneficial effects on the students' learning process. The mechanism is not well understood. It could be entirely due to increased commitment to study the basic sciences. If students in innovative curricula are more enthusiastic about the basic sciences as they are addressed within their particular programme,[38,39] they may be more inclined to spend time studying these sciences, with increased memory and better ability to apply this knowledge. Many discussions in medical education appear to confound the cognitive and commitment aspects of context. Therefore, it is still unclear whether the reported benefits of PBL, or, in general, innovative curricula, are a result of better quality cognitive learning, increased student motivation, or both. In contrast, in our proposed model, any learning context is composed of elements of each of the 3 dimensions: physical, semantic, and commitment. In designing learning contexts, the dimensions should be taken into consideration. For example, early contact with real patients might increase commitment, while at the cognitive level, careful selection of patients might give the best results. Similarly, a clinical environment might foster learning, but can also distract students if the learning task is unrelated to the clinical context. Therefore, to gain insight into the learning process, it is necessary to manipulate particular aspects of 1 dimension, while keeping the learning context with respect to the other dimensions as constant as possible.

Contributors: all authors contributed to the development of the model presented in this paper and to drafting and revising the paper.
Acknowledgements: none.
Funding: none.
Conflicts of interest: none.
Ethical approval: not required.

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Received 28 September 2004; editorial comments to authors 24 November 2004; accepted for publication 21 March 2005