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WEB PAPER

Learning strategies during clerkships and their effects on clinical performance

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Abstract

Background: Previous research revealed relationships between learning strategies and knowledge acquisition. During clerkships, however, students' focus widens beyond mere knowledge acquisition as they further develop overall competence. This shift in focus can influence learning strategy use.

Aim: We explored which learning strategies were used during clerkships and their relationship to clinical performance.

Methods: Participants were 113 (78%) clerks at the university hospital or one of six affiliated hospitals. Learning strategies were assessed using the 'Approaches to Learning at Work Questionnaire' (deep, surface-rational and surface-disorganised learning). Clinical performance was calculated by taking the mean of clinical assessment marks. The relationship between learning strategies and clinical performance was explored using regression analysis.

Results: Most students (89%) did not clearly prefer a single learning strategy. No relationship was found between learning strategies and clinical performance.

Discussion: Since overall competence comprises integration of knowledge, skills and professional behaviour, we assume that students without a clear preference use more than one learning strategy. Finding no relationship between learning strategies and clinical performance reflects the complexity of clinical learning. Depending on circumstances it may be important to obtain relevant information quickly (surface-rational) or understand material thoroughly (deep). In future research we will examine when and why students use different learning strategies.

Introduction

The clinical workplace in which clerks have to develop their competences is complex and continuously changing (Prince et al. 2005; Dornan et al. 2007). As a result workplace learning is less structured than learning during the pre-clinical years, and students are more able to influence their learning processes (Wimmers et al. 2006). One of the ways students can influence their learning processes is by adjusting their learning activities (Coffield et al. 2004; Berings et al. 2005). The term 'learning strategy' is used for any cluster of related learning activities that students can use in reaction to a specific learning goal, assessment procedure or learning environment. In this study we explored which learning strategies clerks use and how these learning strategies relate to clerkship outcomes.

Three learning strategies are generally distinguished in undergraduate medical education: deep, strategic and surface learning (Newble & Entwistle 1986). A deep learning strategy is characterised by students aiming for a thorough understanding, relating ideas from different sources and self-regulation. A strategic learning strategy is characterised by the attempt to achieve high grades while minimizing effort. Medical students who predominantly use the deep and strategic learning strategies have been found to receive higher examination marks (McManus et al. 1998; Martin et al. 2000; Mattick et al. 2004). The contrary is true for

Practice points

- Most students used more than one learning strategy during clerkships.
- No relationship was found between learning strategies and performance during clerkships.
- The focus on all aspects of clinical competence (knowledge, skills and professional behaviour) in clerkships is likely to require multiple learning strategies.
- Using more than one learning strategy seems effective in a complex hospital environment.

surface learning, which includes a lack of self-regulation and a tendency for rote learning (Reid et al. 2007).

However, most of these studies on learning strategies were conducted in pre-clinical medical education and have focused on knowledge acquisition only. During clerkships, knowledge acquisition is still important, but students also need to develop their skills and professional behaviour in order to achieve an integrated whole: clinical competence (Central College of Medical Specialties 2004; Frank 2005). This shift in focus is reflected in the assessment methods (for example mini-CEX or OSCE) used to determine the outcome of clinical training periods. Clinical assessments tend to be focused on clinical competence as a whole, rather than on assessing

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the separate components. As a consequence, students face a different learning content and an adjusted assessment procedure during clerkships in comparison with their pre-clinical training period. As argued in a recent review, a change in learning content or assessment can change the learning strategies students use (Coffield et al. 2004), which indicates that the use of learning strategies during clerkships might differ from that during the pre-clinical training period.

This expectation is further supported by studies on workplace learning in general. Kirby and colleagues (2003) studied workplace learning in several different contexts and found that in the workplace the following distinction in learning strategies would be most appropriate: deep learning (elaboration, self-regulation and thorough understanding), surface-rational learning (structure, routine, memorisation of main issues) and surface-disorganised learning (lack of self-regulation, detailed memorisation) (Kirby et al. 2003). The deep learning strategy they found is very similar to the deep learning strategy as it has been found in classroom learning. Surface-rational learning however, refers to an efficient combination of surface and strategic elements. Surface-disorganised learning finally, is mostly comprised of surface elements, combined with a deep sense of confusion.

However, we could neither find studies that addressed learning strategy use during clerkships nor studies concerning the way different learning strategies affect clinical performance. Therefore, our study was aimed at exploring students' learning strategies during clerkships in order to provide more insight into the effectiveness of students' learning strategies in becoming competent doctors. As it is difficult to accommodate all learning strategies in a clinical curriculum, this insight can be informative when choosing effective teaching methods (Stratman et al. 2008). The following research questions concerning learning strategies were thus formulated:

- (1) Which learning strategies do medical students use during clerkships?
- (2) Do medical students have a preferred learning strategy in their clerkships?
- (3) Do different learning strategies have distinct relationships with clinical performance?

Method

Context

After obtaining approval from the Board of Teaching Directors, this study was conducted at the University Medical Center Groningen, The Netherlands. The medical curriculum in Groningen extends for six years. The pre-clinical curriculum is problem-based and patient-oriented, with clinical skills training mostly positioned in the third and fourth year. In the pre-clinical phase knowledge is tested both immediately (course based assessment) and longitudinally (progress testing). Clerkships start in the student's fifth study year and consist of six 14-week rotations. The first four rotations, which students had to complete in fixed order, were studied: (1) internal medicine, (2) psychiatry and neurology, (3) surgery

and oncology and (4) obstetrics and gynaecology, and paediatrics.

Participants and procedures

The participants ($n=144$) were students on rotation at the University hospital or at one of six affiliated hospitals. These students were asked to complete a learning-strategy questionnaire and for permission to obtain their rotation results. Granting permission was voluntary and confidential and anonymity was guaranteed. All participants received a gift certificate for their efforts. After combining the rotation results with the learning-strategy data, all identifying information was removed to ensure anonymity.

Measuring instruments

The 'Approaches to Learning at Work Questionnaire' (ALWQ, Appendix) was used to assess learning strategies (Kirby et al. 2003). We decided to use the ALWQ because it was specifically developed for workplace learning and had been successfully applied before in a clinical setting (Delva et al. 2002, 2004; McManus et al. 2004). The ALWQ assesses the extent to which each of three learning strategies is used: deep, surface-rational and surface-disorganised learning. The ALWQ consists of 30 items (10 per learning-strategy scale) which students have to rate on a five-point Likert scale (1 = hardly ever do this; 5 = almost always do this). Reliability as expressed in alpha coefficients is approximately 0.7 for each of the ALWQ-scales (Delva et al. 2002, 2004; Kirby et al. 2003). For the purpose of this study the ALWQ was translated into Dutch and then independently back into English to ensure the content of the questionnaire remained the same in the translation. The retranslation was approved by one of the developers of the ALWQ. When necessary, wording was adapted to clerkships, for example 'present job' was replaced by 'present rotation'. Students were asked to complete the ALWQ based on their learning behaviour during that current rotation.

To answer our questions we needed to determine the students' scores in two ways. First, a raw score per student was calculated for each learning strategy by taking the average score of that student on the 10 items belonging to the learning-strategy scale in question. These raw scores indicated the extent to which a student used each of the learning strategies. Second, we needed to determine which learning strategy each student preferred. Based on earlier results with the ALWQ in a clinical setting (Delva et al. 2002, 2004; McManus et al. 2004) and our consultation with one of the developers, preference was defined as a student scoring higher than 3.75 on one learning strategy and lower than 3.25 on the other two. For example: a student who scored 3.8 on the deep scale, 3.2 on the surface-rational scale and 2.9 on the surface-disorganised scale was defined as having a preference for the deep learning strategy; a student who scored 3.8 on the deep scale, 3.6 on the surface-rational scale and 3.3 on the surface-disorganised scale was defined as not having a clear preference on any learning strategy.

Clinical performance was assessed at regular intervals during the clinical rotations. The number of assessments during each rotation varied between five and seven times and at each time a different clinical teacher was involved. The clinical teacher observed the student interacting with a real patient and then rated the performance on the basis of a structured form containing key aspects of clinical performance. Each assessment was completed by providing an overall judgement of the student's clinical performance that could range from 1 (very low) to 10 (very good); in Dutch curricula 5.5 is the cut-off score for adequate performance. The average of the overall judgements was taken as the indicator of the students' overall clinical competence (reliability approximately 0.70).

Analyses

Since the ALWQ had to be translated into Dutch, Cronbach's alpha reliabilities were calculated for each of the three learning-strategy scales. For basic correlational purposes, Cronbach's alpha should be around 0.60, Cronbach's alphas higher than 0.80 are advised for high-stakes decision making in educational or vocational testing (Nunnally 1967). We calculated descriptive statistics on student learning-strategy scale scores and learning-strategy preference. The relationship between learning strategies and clinical performance was assessed using univariate multiple regression analysis (SPSS 14). Learning-strategy scale scores were taken as independent variables and clinical performance as the dependent variable.

Results

In total, 113 (78%) students participated in this study. After translation of the ALWQ, the reliabilities for the three learning-strategy scales (expressed in alpha coefficients) were: deep 0.50, surface-rational 0.55 and surface-disorganised 0.65. The mean score for clinical performance was 7.8 (SD=0.37), ranging from 6.7 to 9.0.

Learning strategy use

On average, students scored highest on the deep learning strategy ($M=3.45$), followed by the surface-rational strategy ($M=3.25$) and finally the surface-disorganised strategy ($M=2.45$) (Table 1).

Most students (89%) did not show a strong preference for a certain learning strategy (Table 2). Those who did, generally preferred the deep learning strategy, followed by the surface-rational learning strategy. None of the students had a preference for the surface-disorganised learning strategy.

Effect on clinical performance

The relationships between learning strategy scores and clinical performance were not statistically significant (Table 3), nevertheless the p -values for the surface-rational learning strategy ($B=0.16$, $p=0.08$) and the surface-disorganised learning strategy ($B=-0.14$, $p=0.07$) were quite low. The deep

Table 1. Use of learning strategies (1 = hardly ever do this; 5 = almost always do this).

Learning strategy	Mean (SD)	Range
Deep	3.45 (0.36)	2.8–4.3
Surface-rational	3.25 (0.40)	1.9–4.2
Surface-disorganised	2.48 (0.49)	1.4–4.0

Table 2. Preference^a for learning strategies and clinical performance assessment.

Preferred learning strategy	Frequency (%)
No preference	101 (89)
Deep	9 (8)
Surface-rational	3 (3)
Surface-disorganised	0 (0)

Note: ^aScored higher than 3.75 on this learning strategy and lower than 3.25 on the other two.

Table 3. Relationship between learning strategies and clinical performance.

Learning strategy	B	$SD(B)$	β	T	p
Constant	7.76	0.49			
Deep	-0.03	0.10	-0.03	-0.32	0.75
Surface-rational	0.16	0.09	0.18	1.77	0.08
Surface-disorganised	-0.14	0.08	-0.19	-1.86	0.07

Note: B = unstandardised regression coefficient; $SD(B)$ = standard error of estimate B ; β = standardised regression coefficient; T = t -test statistic associated with B and $SD(B)$; $R^2 = 0.04$ (n.s.).

learning strategy had no effect on clinical performance ($B = -0.03$, $p = 0.75$)

Discussion

In this study we explored the learning strategies used while developing competence during undergraduate clerkships. Most students (89%) did not have a preference for one learning strategy during their rotation, they used more than one learning strategy. Our study did not reveal any significant relationships between learning strategies and clinical performance.

The deep learning strategy was used most, followed by the surface-rational learning strategy and the surface-disorganised learning strategy, respectively. This pattern is quite similar to that found in earlier studies (Delva et al. 2002, 2004).

In clinical clerkships students need to develop knowledge, skills and professional behaviour simultaneously, resulting in the students having different learning goals at the same time. As argued in a recent review, different learning goals require different learning strategies (Coffield et al. 2004). This line of reasoning can explain our finding that most students used more than one learning strategy. It seems probable that students change their learning strategy depending on which

aspect of competence they are focusing on. It could be argued that the deep learning strategy, with its emphasis on thorough understanding, is suitable for acquiring knowledge. For skills, however, the deep learning strategy would not be that useful. In fact, the surface-rational learning strategy would seem better, as it emphasises memorising protocol and working systematically (see Appendix). This argument is further supported by the finding that students perceived to get different advice on how to learn for knowledge-based assessments than for skills-based examinations (Mattick & Knight 2007).

The question remains as to why we did not find a significant relationship between learning strategies and clinical performance. As both structural knowledge and skills are needed to perform well in clinical practice, at least some relationship could be expected. Finding no relationship between the deep learning strategy and clinical performance could be explained by the complex and presumably stressful nature of clerkships (McManus et al. 2004; Dornan et al. 2007). The deep learning strategy is probably not a good learning strategy in a time-pressured clinical workplace because there may not be enough time to undertake this learning strategy properly. The surface-rational learning strategy may be more suitable: the items in the Appendix show that this is a very systematic learning strategy. Students who are able to switch from one learning strategy to the other may benefit from this (Coffield et al. 2004). We indeed found a positive trend ($p < 0.10$) for the surface-rational learning strategy. The negative trend we observed for the surface-disorganised learning strategy can also be explained following this line of reasoning. Learning in a hectic environment requires students to find some structure. From the items in the Appendix it is clear that students who often use the surface-disorganised learning strategy are not able to do so.

At present we are conducting further research to examine whether students indeed adapt their learning strategies to the different aspects of competence and/or the demands of the hospital environment. In this study we will explore if, when, how and why students adapt their learning strategies.

A strength of our study is the clinical performance assessments used. These assessments were in line with recent literature advocating observed behaviour, a variety of patients and multiple examiners (Wass et al. 2001; Schuwirth 2004).

Another strength of our design is that we gathered data from multiple sites and included multiple disciplines instead of a single discipline at a single site (Issenberg & Mavis 2006). In our study most clinical disciplines were covered and clerks from both academic and non-academic settings were included. Therefore, it can be expected that our results can be generalized to most settings that medical students will encounter during clerkships at least in the Netherlands and likely in most western countries.

A possible limitation of our study is the restriction of range in the performance assessments (all students passed the exam). A restriction of range is typical for clerkship assessments (Kogan et al. 2003; Wimmers et al. 2006; Fernando et al. 2008) and reflects the fact that clerks are advanced students who are assumed to have been adequately trained.

Nevertheless, some differences in performance are inevitable because some students will be better than others. As argued in the methods section, the assessments are reliable enough to distinguish these differences.

Another limitation might lie in the learning-strategy instrument we used. However, we did choose an instrument that was specifically developed for workplace learning and had been applied successfully in a medical setting before (Delva et al. 2002, 2004; McManus et al. 2004). Nevertheless, even after a careful translation process, the Cronbach's alpha reliabilities for the three learning-strategy scales were lower than those found in previous studies (Delva et al. 2002, 2004). These lower reliabilities may influence the outcome of a regression analysis in two ways: (1) the low reliabilities might point to a problem with the validity of the factor structure in the translated version of the ALWQ questionnaire and (2) the lower reliabilities put a limit on estimated strength of any relation obtained through regression analysis (Nunnally 1967). As the absolute number of subjects relative to the number of items in the questionnaire precludes a proper check on the factor structure, we cannot fully exclude this explanation for the lack of relation between learning strategy use and clinical performance. However, given the close similarity between our data and that of earlier studies using the original version of the ALWQ, this does not seem to be the most likely explanation. Using a Spearman attenuation correction to rectify the influence on the estimated strength of the relationship (Nunnally 1967), did not change the overall picture though, indicating that the lower reliabilities did not unduly influence our results.

In summary, most students seemed to use more than one learning strategy and we found no significant relationships between learning strategies and clinical performance. Using more learning strategies could be more efficient because overall clinical competence can be considered to entail the integration of knowledge, skills and professional behaviour and each of these aspects may require different learning strategies. The lack of a relationship between learning strategies and clinical performance may be explained by the complex and stressful nature of clinical learning. Further research will focus on if, when, how and why students use different learning strategies during clerkships.

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Appendix. Approaches to Learning at Work Questionnaire.

No. ^a	
	I. Deep
1	The work I am doing in my present clerkship will be good preparation for other jobs I may have in the future.
2	In trying to understand a puzzling idea, I let my imagination wander freely to begin with, even if I don't seem to be much nearer a solution.
7	In trying to understand new ideas, I often try to relate them to real life situations to which they might apply.
8	I like to play around with ideas of my own even if they don't get me very far.
13	If conditions aren't right for me at work, I generally manage to do something to change them.
14	In my job one of the main attractions for me is to learn new things.
19	I find that studying for new tasks can often be really exciting and gripping.
20	I spend a good deal of my spare time learning about things related to my work.
23	I find it helpful to 'map out' a new topic for myself by seeing how the ideas fit together.
26	Some of the issues that crop up at work are so interesting that I pursue them though they are not part of my job.
	II. Surface-rational
4	When I am given a job to do at work I like to be told precisely what is expected.
5	I generally prefer to tackle each part of a task or problem in order, working out one at a time.
6	When I'm doing a piece of work I try to follow instructions exactly, even if they conflict with my own ideas.
10	I prefer the work I am given to be clearly structured and highly organised.
11	I prefer to follow well tried approaches to problems rather than anything too adventurous.
12	When I learn something new at work I put a lot of effort into memorising important facts.
16	I find it better to start straight away with the details of a new task and build up an overall picture in that way.
17	The best way for me to understand what technical terms mean is to remember the textbook definitions.
18	I think it is important to look at problems rationally and logically without making intuitive leaps.
22	I find I tend to remember things best if I concentrate on the order in which they are presented.
	III. Surface-disorganised
3	In this clerkship I find it difficult to organise my time effectively.
9	I prefer to have a good overview rather than focus on details.
15	The continual pressure of work – tasks to do, deadline, and competition – often makes me tense and depressed.
21	My habit of putting off work leaves me with far too much catching up to do.
24	Supervisors seem to delight in making the simple truth unnecessarily complicated.
25	Often I find I have to read things without having a chance to really understand them.
27	I certainly want to get good performance appraisal, but it doesn't really matter if I only just scrape through.
28	Although I generally remember facts and details, I find it difficult to fit them together into an overall picture.
29	I seem to be a bit too ready to jump to conclusions without waiting for all the evidence.
30	When I look back, I sometimes wonder why I ever decided to work here.

Note: ^aItem numbers indicate the order in which the items were presented to the participants.