

University of Groningen

The clinical learning environment

Hell, Elisabeth Aaltje van

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version

Publisher's PDF, also known as Version of record

Publication date:

2009

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Hell, E. A. V. (2009). *The clinical learning environment: transition, clerkship activities and feedback*. s.n.

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

Chapter 3

Decreasing transition difficulties by alternating skills training and clerkships

Elisabeth A. van Hell
Jan B. M. Kuks
Jan C.C. Borleffs
Janke Cohen-Schotanus

Submitted for publication

ABSTRACT

Context Medical students experience the transition from pre-clinical to clinical training as stressful. To ease this transition we implemented a one-year dual learning programme in which just-in-time skills training and clerkships alternated. Throughout this programme, we examined the students' satisfaction with their workload and skills levels, and stress. We compared these data with a baseline measurement taken from a curriculum in which all skills training was provided in advance of clerkships.

Methods During the fourth year, students completed four rotations in which five weeks of skills training and five-week clerkships alternated. We used a balanced cross-sectional design in which students ($n = 476$) completed questionnaires measuring their satisfaction with workload and skills levels, and stress (GHQ-12) during their second clerkship week. ANOVA was used for trend analysis and to determine differences with the baseline measurement.

Results During the dual learning year, satisfaction with workload and skills levels increased significantly ($F(1,471) = 9.408, p < 0.01$; $F(1,471) = 94.202, p < 0.001$). The students' satisfaction with their workload was higher ($F(5,553) = 7.599, p < 0.001$) and with their skills levels was comparable to the baseline measurement. The students' GHQ-12 scores revealed a negative linear trend at the $p < 0.10$ level ($F(1,471) = 3.309, p < 0.10$).

Conclusions The students were more satisfied with the workload they experienced and the skills they possessed, and they felt less stressed throughout the dual learning year during which skills training and clerkships alternated. Compared to the baseline measurement and the results of earlier studies on transition difficulties, dual learning is a promising innovation to ease the transition.

INTRODUCTION

The transition from pre-clinical to clinical training is a difficult period for medical students.¹⁻⁴ During the transition, students experience high workload and feelings of stress.⁶⁻⁹ As a consequence, cognitive overload may be hampering student learning.¹⁰ In this study we examined whether a dual learning programme in which skills training and clerkships alternate improves students' satisfaction with their workload and decreases their feelings of stress. We compared the data of the dual learning programme with a baseline measurement from a curriculum in which all skills training was offered in the years preceding the clerkships. Furthermore, we analysed if the rearrangement of skills training was not at the cost of students' satisfaction with their skills levels.

In medical education the start of clinical training is one of the main causes of student stress.^{1,2,6} During pre-clinical training the emphasis is on student learning, whereas in clinical training patient care becomes most important. Students experience difficulties with their new roles, the high work pressure, talking to psychiatric patients and with dealing with death and suffering.³⁻⁶ Recently it was found that students experienced most difficulties with their workload and the need for a new instructional model for clerkship learning was put forward.¹⁰ The main aim of such a model should be to ease the transition from pre-clinical to clinical training and in particular to improve the students' satisfaction with their workload during the transition.

Often, all skills training is scheduled in the years preceding the clerkships. The separation between skills training and clerkships could negatively influence the transition, because students learn skills without being able to practise them in a real clinical environment. As Goldstein and Ford state 'it is not possible to understand performance without understanding the social situation in which it occurs'.¹¹ Difficulties concerning the transition from learning in an educational environment to learning in a workplace environment are not unique to medical education. Comparable transition

problems were found in educational programmes for social work, physiotherapy and occupational therapy.¹³⁻¹⁵ It was suggested that to decrease the transition problems, dual learning in which students move back and forth between the educational and workplace environments should be implemented.¹⁵

To facilitate the transition from pre-clinical to clinical training, we developed a dual learning programme in which training periods in an educational environment (skills training) and a workplace environment (clerkships) alternate. Student skills training is organized and structured in such a way as to suit the clinical context that the students are about to enter.¹⁶ During the skills training periods students learn new skills immediately before having to apply them in a real clinical setting. New skills are learnt, just-in-time, in a safe environment where the level of support is decreased gradually and students receive personal feedback when they actually need it. During the subsequent clerkship period, students apply the skills they acquired in the training period and gain the necessary experience in a clinical setting.¹⁵ After finishing a clerkship, students start the next skills training period. At the start of this training period, students reflect on their clerkship experiences and identify their personal learning needs. These learning needs are then further practised in a training environment and the students learn new skills to prepare them for their next clerkship.

Throughout the dual learning year, just-in-time skills training and clerkships alternated, resulting in four skills training periods, each followed by a clerkship. The students thus experienced four mini-transitions from skills training periods to subsequent clerkships, instead of one major transition from pre-clinical training to clerkships. The aim of this instructional model for clerkship learning was to decrease the experienced problems with the workload during the transition. Consequently we hypothesized:

- 1 In a dual learning programme in which skills training and clinical clerkships alternate: students' satisfaction with the workload increases throughout the mini-transitions and is higher than that of students whose transition occurs in a curriculum where all skills training is provided before the clerkships.

Compared to a curriculum in which students received all their skills training before commencing their clerkships, the students in the dual learning programme had received only limited skills training when they started their first clerkships. However, after completion of the dual learning programme, students in the dual learning programme have received as much skills training as students in the baseline measurement. To analyse if the rearrangement of skills training was not at the cost of students' satisfaction with their skills levels we tested the following hypothesis:

- 2 In a dual learning programme in which skills training and clinical clerkships alternate students' satisfaction with their skills levels increases throughout the mini-transitions and at the end of the year it is comparable to that of students whose transition occurs in a curriculum where all skills training is provided before the clerkships.

When comparing the students' levels of stress to the results of previous studies in medical education, our aim was to obtain an overall measure of student stress during the mini-transitions. Since this measure had not been included in the baseline measurement, statistical comparison to a previous curriculum was not possible. We expected that:

- 3 In a dual learning programme in which skills training and clerkships alternate, student stress levels decrease throughout the mini-transitions and remain at an acceptable level.

METHODS

Context

The undergraduate curriculum of the University of Groningen in the Netherlands consists of six years of medical training. The first three years – the pre-clinical years – include competence-based and patient-centred education with limited skills training. Dual learning is implemented in the fourth year, in which skills training and clerkships alternate. This dual learning programme comprises four junior rotations (A – D). Each rotation lasts 11 weeks, starting with one week of training in general medical consultation skills, followed by four weeks of rotation-related skills training – both at the university skills training centre – and one week of exams. All junior rotations end with a five-week clerkship in a medical specialty related to the specific rotation (Table 1). Consequently, students experience a mini-transition at each rotation. To use the capacity of the university hospital efficiently, students start in either rotation A, B, C or D and pass through the junior rotations in random order. Therefore, some of the students experience their first mini-transition in rotation A and others in rotations B, C or D. The same applies to the second, third and fourth mini-transitions. During the fifth year of study students rotate through senior clerkships at affiliated hospitals, and have more responsibilities than in the junior rotations. The curriculum ends with the sixth year, comprising a six-month clinical training period and six months of scientific research training.

Table 1 Four junior rotations and the corresponding medical specialties

A	B	C	D
Rehabilitation	Internal medicine	Surgery	Obstetrics/ gynaecology
Orthopaedics	Pulmonary	Ear, nose and throat	Paediatrics
Rheumatology	Endocrinology		Urology
Neurology	Cardiology		
Psychiatry	Dermatology		
Ophthalmology			

The baseline measurement was taken from the previous six-year curriculum at the same university.¹⁰ In this curriculum clinical skills were learnt over ten trimesters of problem-based and patient-centred learning at the university. The third trimester included a two-week internship in a nursing department and the tenth trimester a two-week training period in a general practice. After this pre-clinical period, students took part in clerkships at the university hospital and affiliated hospitals. Consequently, the students who participated in the baseline measurement experienced one major transition.¹⁰

Participants and procedure

We used a balanced cross-sectional design in this study. This means that students who participated in the dual learning programme were distributed evenly across the four mini-transitions and participated only once in our study. The participants were students in their first (129), second (86), third (74) or fourth (100) mini-transitions in the dual learning programme, or students at the start of their senior clerkships in the fifth year (87). The participants who took part in the dual learning programme were distributed evenly across the junior rotations A (91), B (95), C (121) and D (82) (Table 2). The participants for the baseline measurement were 83 students in the first clerkship of the former curriculum. All the participants were asked to complete questionnaires in the second week of their clerkships. Students were informed about the purpose of the study. Participation was voluntary and anonymity was guaranteed.

Table 2 Number of respondents divided into mini-transitions and junior rotations

Junior rotation	1 st junior rotation	2 nd junior rotation	3 rd junior rotation	4 th junior rotation	Total	1 st senior clerkship
A	32	22	17	20	91	
B	35	13	18	29	95	
C	34	29	23	35	121	
D	28	22	16	16	82	
Total	129	86	74	100		87

Instruments

Satisfaction with workload and skills level

Students' satisfaction with their workload and skills levels was measured by the scales 'appropriate workload' and 'have enough [patient contact] skills' from the transition questionnaire of Prince *et al.*, modified by Van Hell *et al.*^{9,10} From both scales we omitted one item irrelevant for the dual learning year. Consequently, the new scales consisted of four workload satisfaction and 12 skills satisfaction items, which had to be scored on a 5-point Likert scale. A scale score was obtained by calculating the mean of the items after the inversion of negatively worded items (1 = low satisfaction, 5 = high satisfaction). In the baseline measurement, the original scales were found to be reliable with alphas of 0.70 and 0.83, respectively.¹⁰

Stress

To measure the students' levels of stress, the Dutch version of the General Health Questionnaire with 12 items (GHQ-12) was used. The GHQ-12 was scored using the standard 0-0-1-1 method for each item, which allows a maximum score of 12.^{17,18} The threshold score indicating psychiatric morbidity (a so-called case) is dependent on the research population.¹⁷ To enable comparison with other medical education programmes, we considered a threshold score of ≥ 4 to represent a 'case'. Student stress levels were not measured as part of the baseline measurement.

Statistical analysis

Reliability coefficients (Cronbach's α) were determined for all three measurements. To check the validity of the measurements, Pearson correlations were performed to analyse the relationship between students' satisfaction with their workload, satisfaction with their skills levels and stress. The mean scores and standard deviations were calculated for satisfaction with workload, satisfaction with skills level and GHQ-12 scores. This was done for the whole sample of participants and for the gender, mini-transition and junior rotation subgroups. In the same way, the percentage of students scoring above threshold in the GHQ-12 was

calculated. Chi-square tests were used to analyse differences in GHQ-12 threshold percentages. ANOVAS were performed to analyse differences in satisfaction with workload, satisfaction with skills level and GHQ-12 scores, and to determine linear trends as the students progressed through the mini-transitions. Finally, we analysed differences in satisfaction with workload and skills level between the scores per mini-transition and the baseline measurement by means of ANOVAS with post hoc Bonferroni.

RESULTS

Of the 549 students in the dual learning programme, 476 (87%) completed the questionnaires. Of these respondents, 74% were women, which is representative of the gender distribution of medical students at the university under study (3 respondents did not indicate their gender). The Cronbach's α was 0.66 for satisfaction with workload, 0.78 for satisfaction with skills level and 0.80 for the GHQ-12. Significant correlations were found between satisfaction with workload and satisfaction with skills level ($r = 0.297, p < 0.01$), between satisfaction with workload and stress levels ($r = -0.367, p < 0.01$), and between satisfaction with skills level and stress levels ($r = -0.266, p < 0.01$).

Satisfaction with workload

Overall, the students were moderately satisfied with the workload they experienced (mean = 3.22, SD = 0.73). Women scored significantly lower on satisfaction with workload than men ($t(471) = 2.239, p < 0.05$). Mini-transitions differed significantly with respect to satisfaction with workload ($F(4,471) = 3.515, p < 0.01$), and increased as students progressed through the mini-transitions ($F(1,471) = 9.408, p < 0.01$) (Table 3, Figure 1).

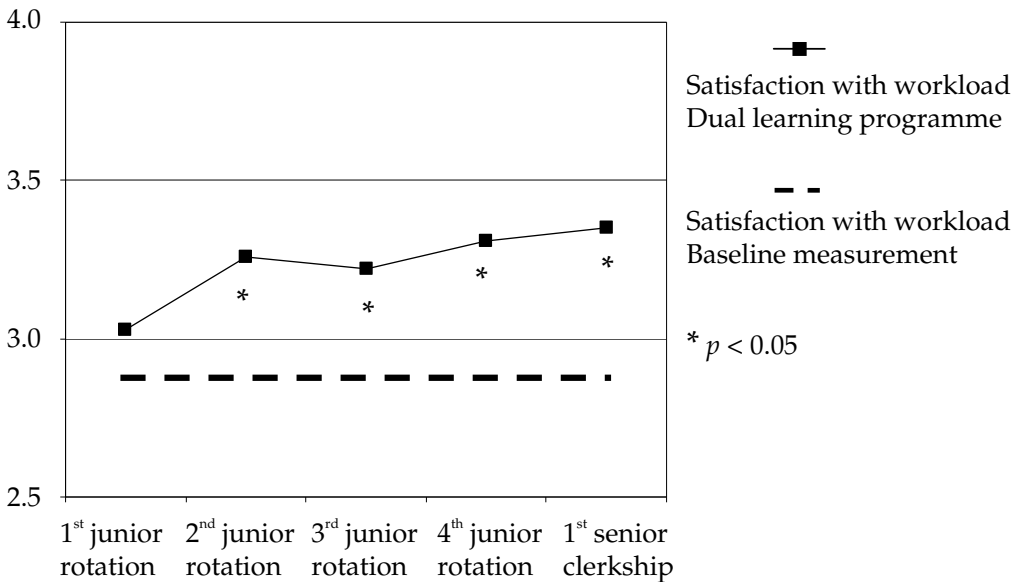
Chapter 3

Table 3 Mean scores and standard deviations for satisfaction with workload, satisfaction with skills level (1 = low satisfaction, 5 = high satisfaction) and GHQ-12 score

	1 st junior rotation	2 nd junior rotation	3 rd junior rotation	4 th junior rotation	1 st senior clerkship	F/ χ^2
Satisfaction with workload						
Mean (SD)	3.03 (0.66)	3.26 (0.66)	3.22 (0.81)	3.31 (0.74)	3.35 (0.76)	3.515 [†]
Satisfaction with skills level						
Mean (SD)	3.39 (0.40)	3.60 (0.42)	3.73 (0.42)	3.88 (0.37)	3.86 (0.38)	28.701 [†]
GHQ-12						
Mean (SD)	2.25 (2.36)	1.73 (1.92)	2.47 (2.62)	1.96 (2.80)	1.45 (2.20)	2.471 [*]
% cases	23.3	15.1	25.7	20.0	13.8	5.757

* $p < 0.05$; [†] $p < 0.01$; [‡] $p < 0.001$; SD = standard deviation

Figure 1 Mean scores for satisfaction with workload. Dual learning programme, divided into mini-transitions, and baseline measurement

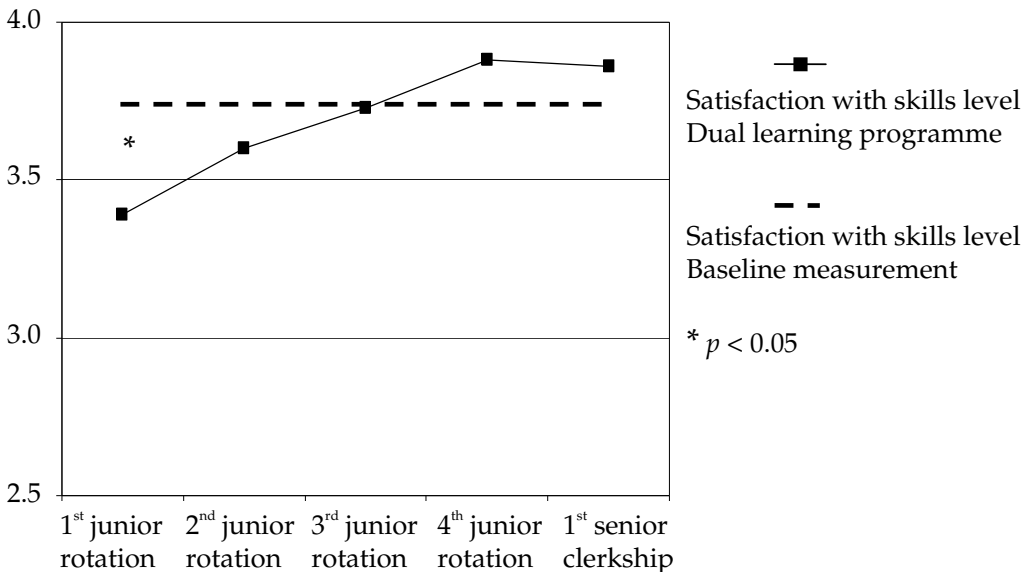


The baseline measurement showed that students were not satisfied with the workload (mean = 2.80, SD = 0.69) during their transition. Compared to this measurement, students in the second, third and fourth mini-transition or at the start of the fifth year of the dual learning programme were significantly more satisfied with the workload they experienced ($F(5,553) = 7.599, p < 0.001$).

Satisfaction with skills level

Students felt relatively satisfied with the skills they possessed (mean = 3.67, SD = 0.44). Women scored significantly lower on satisfaction with skills level than men ($t(471) = 4.198, p < 0.001$). Mini-transitions differed significantly with respect to mean scores on satisfaction with skills level ($F(4,471) = 28.701, p < 0.001$), and increased as students progressed through the mini-transitions ($F(1,471) = 94.202, p < 0.001$) (Table 3, Figure 2).

Figure 2 Mean scores for satisfaction with skills level. Dual learning programme, divided into mini-transitions and baseline measurement

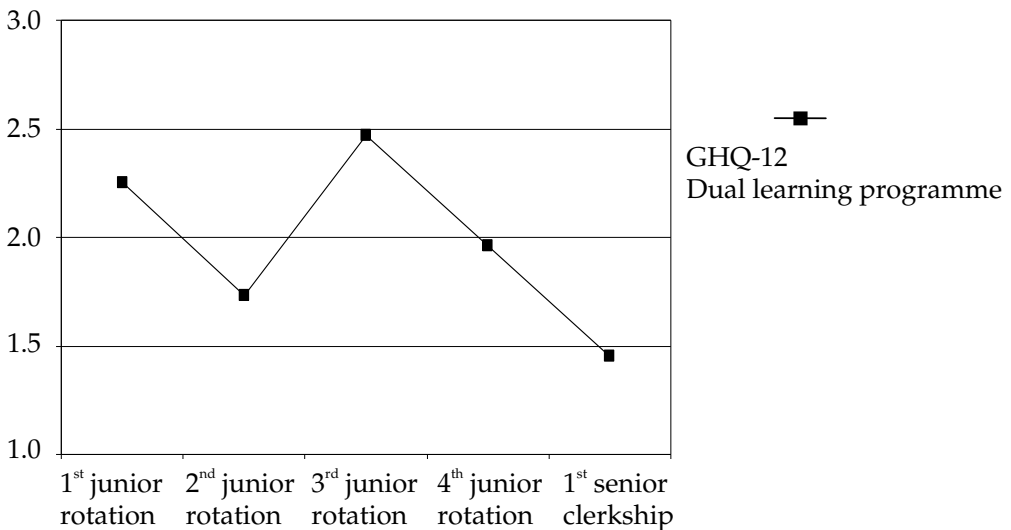


Students who participated in the baseline measurement were relatively content with the skills they possessed during the transition (mean = 3.73, SD = 0.48). Compared to the baseline measurement, students in the first junior rotation of the dual learning programme had significantly lower skills satisfaction scores ($F(5,553) = 21.771, p < 0.001$). Students in the second, third and fourth junior rotation or at the start of the first senior clerkship did not differ significantly from students who participated in the baseline measurement.

Stress

Overall, students had a mean GHQ-12 score of 1.98 (SD = 2.42) and 19.7% of all students scored above the GHQ-12 threshold. The women’s GHQ-12 scores were significantly higher than the men’s ($t(274.15) = -2.860, p < 0.01$). Mini-transitions differed significantly with respect to the mean GHQ-12 score ($F(4,471) = 2.471, p < 0.05$) and displayed a negative linear trend at the $p < 0.10$ level as the students progressed through the mini-transitions ($F(1,471) = 3.309, p < 0.10$) (Table 3, Figure 3).

Figure 3 Mean score for GHQ-12. Dual learning programme divided into mini-transitions



Differences between rotations

Within the dual learning programme, students experienced their first, second, third or fourth mini-transition in different junior rotations. Junior rotations did not differ with respect to the students' satisfaction with their skills levels ($F(3,385) = 0.371, p = \text{n.s.}$), GHQ-12 scores ($F(3,385) = 1.097, p = \text{n.s.}$) and GHQ-12 cases percentage ($\chi^2 = 0.686, df = 3, p = \text{n.s.}$). Students in junior rotation A were significantly more satisfied with the workload than students in rotations B and C ($F(3,385) = 11.169, p < 0.001$).

DISCUSSION AND CONCLUSIONS

In this study we investigated students' satisfaction with their workload and skills levels and stress in a dual learning programme aimed at easing the transition from pre-clinical to clinical training. The results indicated that the students' satisfaction with their workload and skills levels increased, and that their stress levels decreased proportionately as they progressed through the successive mini-transitions. Compared to the baseline measurement, the students' satisfaction with their workload was found to be higher from the very start and over the whole dual learning year. Comparing our data to those of a previous study conducted at another university, the students who participated in the dual learning programme were more satisfied with their workload.⁹ Since the high workload students experience has previously been indicated as the major transition difficulty, this is an important finding.¹⁰ It seems that by alternating just-in-time skills training and clerkships, students become more satisfied with their workload. Furthermore, it may be the case that since students who participate in the dual learning programme are aware that they will return to the training environment after five weeks, they are better able to deal with workload difficulties.

Skills training is often distributed across the pre-clinical years of medical training. In our dual learning programme skills training is largely concentrated in the fourth year of medical training. At the start of the first

clerkship, the students who participated in the baseline measurement had received much more skills training than students in the dual learning programme at the stage of their first mini-transition. Therefore, it not surprising that the latter experienced lower satisfaction with their skills levels. However, once these students were in their second mini-transition, they had made up the arrears. So the second hypothesis was largely confirmed. Future studies should examine whether the actual skills levels of students participating in the dual learning programme are comparable with those of students in other curricula.

Previous studies have reported a great range in the stress levels medical students experience.^{3,18-23} Compared to other medical education programmes, the stress levels students experienced during the first mini-transition of the dual learning programme correspond to the average percentage (15 – 35 percent) of students experiencing psychiatric distress.^{3,18,20-23} These levels are higher than in the general Dutch population, but lower than in a psychiatric patient population.¹⁷ The negative linear trend ($p < 0.10$) in student stress scores indicates that as the students progressed through the mini-transitions their stress levels decreased. By the time the students had started their first senior clerkship, their stress levels had decreased significantly, with only 13.8 percent of students scoring above threshold. At that point, the students' stress levels were comparable with those of the general Dutch population.¹⁷ A benefit of our dual learning programme is that students' stress levels decreased to a much lower level than those reported in earlier studies in medical education.^{3,18,20-23}

In the dual learning programme gender differences occurred for students' satisfaction with their workload and skills levels and stress. Women experienced more stress than men, which is in line with the results of several previous studies.^{3,18-22} Furthermore, women scored significantly lower than men for satisfaction with workload and satisfaction with skills level. Since no gender differences occurred in the baseline measurement,¹⁰ it is possible that men benefit more from the dual learning programme than women. Further research should be performed to provide more insight into

the causes and effects of these gender differences in satisfaction with workload, satisfaction with skills level and stress levels.

Since the students attended the four rotations in random order, we were able to examine the differences between rotations A, B, C and D, independently of whether it was the students' first, second, third or fourth mini-transition. We only found differences between rotations with respect to the students' satisfaction with their workload. To ease the transition, we would prefer students to start in a clerkship with a relatively low workload and increase the workload gradually. This would imply that all students should start their first clerkship in a medical speciality from rotation A, their second in a medical speciality from rotation D and continue their third and fourth clerkships in the medical specialities from rotations B or C. However, due to the large number of students enrolled in our medical programme it is logistically impossible to schedule this kind of clerkship sequence for all students. In stead we could adjust the content of the preparatory courses for rotations B and C and discuss workload issues during small group sessions. Future studies should examine (1) the differences in satisfaction with workload between the rotations, (2) whether specific medical specialities within the rotations are perceived to have high or relatively higher workload levels and (3) whether differences in satisfaction with workload are caused by the workload students experience or by their actual working hours and clerkship activities.

The strength of this study is the use of a balanced cross-sectional design in which the participating students were distributed evenly across the four mini-transitions and rotations. This design prevented questionnaire fatigue among students, which might negatively influence the measurements. On the other hand, this choice implies that the gathered data are not purely longitudinal. In the dual learning programme, the same instrument to measure the students' satisfaction with their workload and skills levels was used as in the baseline measurement. We were thus able to explore the dual learning programme and make a valid comparison with the former curriculum. Furthermore, the reliability of the scales used was acceptable

and computed correlations were all significant and in the expected direction. These arguments contribute to the reliability and validity of the presented findings. A possible limitation of this study is that students' self-reports were used to determine transition difficulties. The influence of dual learning on the students' actual workload and skills levels remains unknown. However, student learning is influenced by their interpretation of the learning environment, rather than by the objective learning environment.²⁵ Therefore, it is a rational choice to focus on transition difficulties as perceived by the students.

Transition difficulties have already been identified by other researchers, but as far as we know, a curriculum change aimed at easing the transition was lacking. We implemented a dual learning programme to ease the transition from pre-clinical to clinical training. A comparison of the results of our study with those of a baseline measurement from a former curriculum, and earlier studies on transition difficulties in medical education, showed that dual learning in which skills training and clerkships alternate is a promising innovation to ease the transition.

REFERENCES

- 1 Alexander DA, Haldane JD. Medical education: a student perspective. *Med Educ* 1979;**13**:336–41.
- 2 Walker LG, Haldane JD, Alexander DA. A medical curriculum: evaluation by final-year students. *Med Educ* 1981;**15**:377–82.
- 3 Firth J. Levels and sources of stress in medical students. *BMJ* 1986;**292**:1177–80.
- 4 Moss F, McManus IC. The anxieties of new clinical students. *Med Educ* 1992;**26**:17–20.
- 5 Prince KJAH, van de Wiel MWJ, Scherpbier AJJA, van der Vleuten CPM, Boshuizen HPA. A qualitative analysis of the transition from theory to practice in undergraduate training in a PBL-medical school. *Adv Health Sci Educ* 2000;**5**:105–16.

- 6 Radcliffe C, Lester H. Perceived stress during undergraduate medical training: a qualitative study. *Med Educ* 2003;**37**:32–8.
- 7 Seabrook MA. Clinical students' initial reports of the educational climate in a single medical school. *Med Educ* 2004;**38**:659–69.
- 8 Hayes K, Feather A, Hall A, Sedgwick P, Wannan G, Wessier-Smith A, Green T, McCrorie P. Anxiety in medical students: is preparation for full-time clinical attachments more dependent upon differences in maturity or on educational programmes for undergraduate and graduate entry students? *Med Educ* 2004;**38**:1154–63.
- 9 Prince KJAH, Boshuizen HPA, van der Vleuten CPM, Scherpbier AJJA. Students' opinions about their preparation for clinical practice. *Med Educ* 2005;**39**:704–12.
- 10 van Hell EA, Kuks JBM, Schönrock-Adema J, van Lohuizen MT, Cohen-Schotanus J. Transition to clinical training: influence of pre-clinical knowledge and skills, and consequences for clinical performance. *Med Educ* 2008;**42**:830–7.
- 11 Goldstein IL, Ford JK. *Training in organizations: needs assessment, development, and evaluation*, 4th edn. Belmont,CA: Wadsworth/Thomson learning 2002;85–137.
- 12 Dornan T, Littlewood S, Margolis SA, Scherpbier A, Spencer J, Ypinazar V. How can experience in clinical and community settings contribute to early medical education? A BEME systematic review. *Med Teach* 2006;**28**:3–18.
- 13 Elliott J. A model of professionalism and its implications for teacher education. *Br Educ Res J* 1991;**17**:309–318.
- 14 Eraut M. Non-formal learning and tacit knowledge in professional work. *Br J Educ Psychol* 2000;**70**:113–136.
- 15 Le Maistre C, Paré A. Learning in two communities: the challenge for universities and workplaces. *J Workplace Learn* 2004;**16**:44–52.
- 16 Janssen-Noordman AMB, van Merriënboer JJG, van der Vleuten CPM, Scherpbier AJJA. Design of integrated practice for learning professional competences. *Med Teach* 2006;**28**:447–452.
- 17 Koeter MWJ, Ormel J. *General Health Questionnaire*. Nederlandse bewerking handleiding. Lisse: Swets and Zeitinger 1991.

- 18 Goldberg DP, Gater R, Sartorius N, Ustun TB, Piccinelli M, Gureje O, Rutter C. The validity of two versions of the GHQ in the WHO study of mental illness in general health care. *Psychol Med* 1997;**27**:191–7.
- 19 Lloyd C, Gartrell NK. Psychiatric symptoms in medical students. *Compr Psychiatr* 1984;**6**:552–65.
- 20 Toews JA, Lockyer JM, Dobson DJG, Simpson E, Brownell AKW, Brenneis F, MacPherson KM, Cohen GS. Analysis of stress levels among medical students, residents, and graduate students at four Canadian schools of medicine. *Acad Med* 1997;**72**:997–1002.
- 21 Guthrie E, Black D, Bagalkote H, Shaw C, Campbell M, Creed F. Psychological stress and burnout in medical students: a five-year prospective longitudinal study. *J R Soc Med* 1998; **91**: 237–43.
- 22 Niemi PM, Vainiomäki PT. Medical students' distress - quality, continuity and gender differences during a six-year medical programme. *Med Teach* 2006;**28**:136–41.
- 23 Ross S, Cleland J, Macleod MJ. Stress, debt and undergraduate medical student performance. *Med Educ* 2006;**40**:584–9.
- 24 Aktekin M, Karaman T, Senol YY, Erdem S, Erengin H, Akaydin M. Anxiety, depression and stressful life events among medical students: a prospective study in Antalya, Turkey. *Med Educ* 2001;**35**:12–7.
- 25 Lowyck J, Elen J, Clarebout G. Instructional conceptions: analysis from an instructional design perspective. *Int J Educ Res* 2004;**41**:429–44.