Effects of basic clinical skills training on objective structured clinical examination performance

Jana Jünger,[1] Sybille Schäfer,[1] Christiane Roth,[1] Dieter Schellberg,[1] Miriam Friedman Ben-David[2] & Christoph Nikendei[1]

OBJECTIVES The aim of curriculum reform in medical education is to improve students' clinical and communication skills. However, there are contradicting results regarding the effectiveness of such reforms.

METHODS A study of internal medicine students was carried out using a static group design. The experimental group consisted of 77 students participating in 7 sessions of communication training, 7 sessions of skills-laboratory training and 7 sessions of bedside-teaching, each lasting 1.5 hours. The control group of 66 students from the traditional curriculum participated in equally as many sessions but was offered only bedside teaching. Students' cognitive and practical skills performance was assessed using Multiple Choice Question (MCQ) testing and an objective structured clinical examination (OSCE), delivered by examiners blind to group membership.

RESULTS The experimental group performed significantly better on the OSCE than did the control group ($P < 0.01$), whereas the groups did not differ on the MCQ test ($P < 0.15$). This indicates that specific training in communication and basic clinical skills enabled students to perform better in an OSCE, whereas its effects on knowledge did not differ from those of the traditional curriculum.

CONCLUSION Curriculum reform promoting communication and basic clinical skills are effective and lead to an improved performance in history taking and physical examination skills.

[1]Medical Hospital, University of Heidelberg, Germany
[2]Centre for Medical Education, University of Dundee, UK

Correspondence: Dr Christoph Nikendei, Medical Hospital of the University of Heidelberg, Department of General Internal and Psychosomatic Medicine, Medizische Universitätsklinik Heidelberg, Im Neuenheimer Feld 410, 69120 Heidelberg, Germany.
Tel: ++6221 56 38663; Fax: ++6221 56 5749;
E-mail: Christoph.Nikendei@med.uni-heidelberg.de

KEYWORDS clinical competence/ *standards; teaching/ *methods; education, medical, undergraduate/ *methods; *communication; physical examination/ standards; medical history taking/ standards; curriculum.

*Medical Education 2005; **39**: 1015–1020*
doi:10.1111/j.1365-2929.2005.02266.x

INTRODUCTION

Basic clinical skills training in undergraduate medical education in internal medicine is important for the improvement of the doctor–patient relationship and for patient safety.[1,2] The importance of these skills is most evident from research showing that a lack of training results in deficits in students' communication skills[3] and clinical technical skills.[4,5] Despite the importance and high acceptance of communication and technical skills training[6–8] there remains a need for studies investigating the effects of skills training on knowledge and on the ability to perform basic clinical skills.

Remmen *et al.*[9] surveyed 23 Maastricht students and 342 students in Ghent and Antwerp using a survey which covered questions on 265 skills necessary for routine activities in 8 body systems. Results showed that students trained using the reformed curriculum with integrated skills training reported performing significantly more skills than the students of the traditional curriculum. However, this study was retrospective and the quality of skills performed was not assessed.

A second study undertaken by Remmen *et al.*[10] investigated clinical skills abilities covering elementary procedures and physical diagnosis in all areas of clinical medicine, through the use of a written skills

Overview

What is already known

The training of basic clinical skills with undergraduate students leads to performing significantly more skills on the ward and to a better OSCE performance in pre/post-evaluation.

What this study adds

The combination of a special structured basic clinical skills training and training with real patients leads to improved OSCE performance over bedside-teaching alone.

Suggestions for further research

There is a need for more research to elucidate which skills are best learned in which setting.

test. Of the 859 participating students, those trained using a reformed curriculum incorporating skills training demonstrated better skills performance than those trained traditionally. However, student performance was not evaluated using objective measures and it is unclear whether the effects were due to the curriculum as a whole or specifically to the skills training.

Bradley and Bligh[11] examined basic clinical skills in 210 first-year students, comparing a formative objective structured clinical examination (OSCE) prior to the skills training with a summative OSCE following the training. While students did demonstrate improved basic clinical skills at the follow-up OSCE, the study failed to include a control group.

In order to pilot-test the reformed curriculum at the University of Heidelberg, Germany (HEICUMED[12]) the presented study was performed. The aim of the study was to prove the effectiveness of specific training in basic clinical skills in internal medicine [i.e. history taking, physical examination, venupuncture or interpreting electrocardiograms (ECGs)] on OSCE performance of medical students in comparison to the effectiveness of traditional bedside teaching.

METHODS

Sample

Two parallel groups of students belonging to natural cohorts were investigated during the transition period from the traditional to the reformed curriculum. The experimental group consisted of 66 students (40 male, 26 female), the control group of 77 participants (48 male, 29 female). We included all students who completed the entire course. Students who completed only part of the course because of starting scientific work or due to international exchange programmes were excluded. The majority of students from both groups (77.3% experimental group, 70.2% control group) were in their fourth year of training and had a mean age of 24 years (23.9 experimental group; 24.7 control group). Significantly more students in the control group than in the experimental group had completed voluntary internships in internal medicine (63.6% versus 45.5%; $P < 0.02$). There were no significant differences in other medicine-associated professional experiences between the two groups.

Design and learning objectives

The pilot project lasted 1 year and utilised a static group design. The experimental group training included 7 thematic units structured into 1 skills-laboratory session, 1 session of communication training and 1 session of bedside teaching. Each session lasted 1.5 hours. The only teaching method used to train the control group was the traditional bedside teaching. Both groups had the same learning objectives of medical history taking, physical examination and ECG interpretation. The experimental group had additional learning objectives including performing invasive procedures, something not assessed in the OSCE. Bedside teaching took place in groups of 4–6 students. Pairs of students took a patient history, performed a physical examination and presented to each other pathological findings and their approach to the patient, all under the supervision of a tutor. Total teaching time did not differ between the groups. Group size was 10 in the experimental group during communication and skills training and 5 each for the experimental and control groups during bedside teachings.

In the skills-laboratory training for the experimental group, the basic technical procedures listed in Table 1 were practised mainly through role-plays.[13] The communication training with standardised

Table 1 Skills-laboratory sessions attended by intervention group

	Skills-laboratory sessions: learning themes
I: Gastroenterology	
Part 1	Ascites puncture on dummies
Part 2	Introduction of a nasogastric tube
II: Cardiology	
Part 1	Recording and analysing electrocardiograms
Part 2	Measuring of blood pressure/performing Doppler sonography
III: Pulmonology	
Part 1	Auscultation of the heart and lungs with the auscultation trainer Artificial ventilation and intubation on dummies
Part 2	Arterial puncture and blood–gas ascertainment and spirometric examination
IV: Physical examination	
Part 1	Physical examination on paired partner
Part 2	Manual and sonographical examination of the thyroid gland
V: Sonography	
Part 1	Computer based training abdominal sonography
Part 2	Abdominal sonography on paired partner
VI: Invasive procedures	
Part 1	Management of blood transfusion including drawing blood
Part 2	Management of a bladder catheter on dummies
VII: Regulation of blood circulation	
Part 1	Tilting table examination
Part 2	Principles of psychophysiology and biofeedback

patients[14] focused on history taking (see Table 2), but also considered aspects of clarification with patients (session VII) and of dealing with relatives, including requests for organ donation (session V).

Accompanying lectures concerning general and special internal medicine were held 3 times a week for both groups. Each lecture lasted 90 minutes.

Efficiency control

At the end of the coursework, all students were required to take an objective structured clinical examination (OSCE)[15] and a multiple-choice test, both described below.

Objective structured clinical examination (OSCE)

Due to reasons of feasibility during the transitional phase of curriculum development we designed a 5-station OSCE as a first step for evaluation. Each station lasted 5 minutes. Contents of the OSCE were chosen carefully in order to ensure that both the experimental and the control groups had equal opportunities during their sessions to acquire the necessary skills. Students were required to demonstrate proof of history-taking abilities, physical

Table 2 Communication training sessions attended by intervention group

I: Taking a medical history
- Case 1: subacute myocardial infarct;
- Case 2: cardiac insufficiency

II: Handling patients with acute problems
- Case 1: biliary colic;
- Case 2: upper gastrointestinal bleeding

III: Handling patients with acute and chronic lung diseases
- Case 1: pneumonia;
- Case 2: chronic obstructive pulmonary disease

IV: Dialogue with patients with incurable illnesses
- Case 1: colon cancer;
- Case 2: liver cirrhosis

V: Talking to relatives
- Case : brain death and organ donation

VI: Taking a psychosomatic history
- Case 1: somatoform disorder;
- Case 2: bulimia nervosa

VII: Handling noncompliant patients
- Case 1: diabetes mellitus;
- Case 2: hyperthyroidism

Table 3 OSCE stations for experimental group and control group

OSCE stations

Station I: standardised patient I/history taking
History taking with a patient with an arterial occlusive disease
Station II: standardised patient II/history taking
History taking with a patient with Crohn's disease
Station III: interpretation of the electrocardiogram
ECG with signs of myocardial infarction
Station IV: standardised patient III/physical examination
Abdominal examination on a standardised patient
Station V: computer-based station
Auscultation sound of aortic stenosis

examination skills and the competent handling and interpretation of diagnostic findings (ECG and auscultation; see Table 3).

Students in both the experimental and the control groups were divided randomly into groups of 5 before taking the OSCE. Each group rotated from station to station. All examiners received special OSCE training before participating and were blind to group membership. Examiners were asked to rate student performance according to a German School grading system of 1–6 (1 = very good; 6 = unsatisfactory). To ensure a more systematic rating process, all examiners were provided with checklists.

MCQ test

Cognitive knowledge in internal medicine was assessed using a written MCQ test. Students were given 40 minutes to complete the test, which consisted of 30 questions. According to the number of solved questions, the test was also rated with grades from 1 to 6 (see above). The minimum score required in order to pass was 60%.

Statistical analysis

The data are presented as mean ± SD, except where specified otherwise. To test for significant mean differences between the experimental and control groups, a 2-sample *t*-test was used. To test for differences between the OSCE and MCQ test results a paired *t*-test was used. Reliability of the OSCE was calculated with 'the greatest lower bound of reliability (GLB)' as a more appropriate lower limit of reliability.[16]

RESULTS

Students in the experimental group performed significantly better on the OSCE than did those in the control group ($P < 0.01$; see Table 4). The 2 groups did not differ significantly in their MCQ test results ($P < 0.15$), although the average grade was higher in the experimental group.

The experimental group performed significantly better at the 2 history-taking stations with standardised patients ($P < 0.05$ and $P < 0.04$, respectively; see Table 4). Even greater were the differences between the experimental group and the control group with respect to the physical examination task ($P < 0.03$) and the analysis of the ECG ($P < 0.01$). Performance at the computer-based station with the interpretation of auscultation sounds was rated equally in both groups ($P < 0.45$). Reliability of our OSCE calculated with greatest lower bound to reliability was 0.445.

DISCUSSION

Our study showed that students participating in a communication and basic clinical skills curriculum

Table 4 Performance at single OSCE stations and OSCE overall performance for experimental group and control group

OSCE station	M	SD	M	SD	*P*
SP I history taking	2.09	0.81	2.37	0.91	< 0.05
SP II history taking	1.98	0.73	2.24	0.77	< 0.04
Electrocardiogram	2.09	0.97	2.82	1.02	< 0.01
SP III physical examination	2.03	0.89	2.36	0.91	< 0.03
Auscultation sounds	2.82	1.04	2.96	1.20	< 0.45
OSCE overall performance	2.24	0.43	2.55	0.52	< 0.01

with intermittent sessions of bedside-teaching performed significantly better on an OSCE and demonstrated better communication and basic clinical skills than students participating only in bedside teaching. Cognitive performance, however, was the same in both groups.

Our results showed that special communication and basic skills training is highly effective. Additionally, no extra teaching time is required, as it is possible to reduce bedside-teaching time in favour of other teaching units. In the same period of time, a comparable level of knowledge is reached and it is possible to significantly enhance clinical skills. Moreover, the experimental group was exposed to and practised more basic skills in their teaching units than students in the control group. Finally, using a static group design, we were able to confirm results of written skills tests[10] and OSCE-progress tests.[11] However, more time and money are needed to implement and maintain special communication courses with standardised patients and special skills training in a skills-laboratory setting.

When analysing the individual OSCE stations, we found that it was communication skills and those skills requiring supervision and guidance on which students performed better. One advantage of the communication and skills-laboratory training is the structured supervision, which ensures that each individual student has been trained and all skills have been addressed. As reported in several studies, structured feedback seems to be a particularly important factor in improving communications skills.[8,17,18]

Limitations

The reliability of our OSCE was relatively low. However, Roberts and Norman[19] also reported a Cronbach's alpha reliability of only 0.198 in a 10-station OSCE, despite a very high interrater-reliability of 0.8–0.99 and a high retest reliability of 0.66–0.86. The authors assumed that, due to the multidimensional nature of the skills assessed, the different practical skills in their OSCE were only moderately correlated, thus making it impossible to generalise the performance at one station to another. Therefore, a correlation between the scores of the stations can not be expected.

CONCLUSIONS

We conclude that a structured training consisting of communication training, basic clinical skills training and bedside teaching leads to an improvement in history taking and physical examination skills, compared to bedside teaching only. We found the structured training to be superior to the traditional bedside courses, despite the fact that the students in the experimental group were taught in larger groups and were taught more skills in the same period of time. The fact that the experimental group consisted of less experienced students makes these results all the more impressive.

Contributors: JJ was the driving force behind the fundraising, planning and organisation of the study. She was responsible for the engagement of qualified staff to develop the training elements, supervised the development of communication and skills sessions and accompanied SS's doctoral dissertation. She was also involved in planning the OSCE and data collection. She was the main contributor to this article. SS was involved in the planning of single communication and skills laboratory sessions and responsible for the maintenance of the skills laboratory during the study. She supported the planning and organisation of the OSCE. Her main involvement was in data collection and analysis. Her contribution to this article was the literature search and discussion in light of findings from the published works. DS was mainly responsible for the planning of the evaluation of the study in statistical terms. For this he was involved from the beginning in developing the study design. He supervised data collection and statistical analysis and contributed mainly to the methodological sections of this article. CR supported the development of the communication and skills laboratory sessions. She was involved in the training of standardised patients for the training sessions and the OSCE. Her main responsibility was the MCQ test and data collection. She was involved in the literature review and proofreading of this article. MFBD was mainly involved in the planning of the study design and the OSCE. She was a general supervisor for our whole team and was most helpful in assisting us throughout and in proofreading this article. CN developed most of the histories of the standardised patients and developed the design of most of the skills laboratory sessions. In addition he was responsible for the set-up of the OSCE. Furthermore, he was the supervisor of SS's doctoral dissertation. He conducted the main body of the work on this article in collaboration with JJ.

Acknowledgements: we would like to thank Miriam Friedman Ben-David, who supported our work and research and supervised our team during all stages of the study. We appreciated the warm and welcoming manner with which she shared her expert knowledge. Shortly after we completed this article we learned of her sudden death.

Funding: this study was supported by the Ministerium für Wissenschaft, Forschung und Kunst Baden-Wurtemberg, Germany (Ministry for Science, Research and Art). Project identification number: D100 114 40; Kap. 1423 Tit Gr. 71.

Conflicts of interest: none.
Ethical approval: no ethical approval was sought for this study.

REFERENCES

1 Jolly BC, Macdonald MM. Education for practice. The role of practical experience in undergraduate and general clinical training. *Med Educ* 1989;**23**:189–95.
2 General Medical Council. *Tomorrow's Doctors. Recommendations on Undergraduate Medical Education*. London: General Medical Council 1993.
3 Maguire GP, Rutter DR. History taking for medical students: I. Deficiencies in performance. *Lancet* 1976;**2**:556–8.
4 McManus IC, Richards P, Winder BC, Sproston KA, Vincent CA. The changing clinical experience of British medical students. *Lancet* 1993;**341**:941–4.
5 Remmen R, Scherpbier AJJA, Derese A, Denekens J, Hermann I, van der Vleuten CPM, Van Royen P, Bossaert L. Unsatisfactory basic skills performance by students in traditional medical curricula. *Med Teach* 1998;**20**:579–82.
6 Das M, Townsend A, Hasan M. The views of senior students and young doctors of their training in a skills laboratory. *Med Educ* 1998;**32**:143–9.
7 Owen H, Plummer JL. Improving learning of a clinical skill: the first year's experience of teaching endotracheal intubation in a clinical simulation facility. *Med Educ* 2002;**36**:635–42.
8 Kneebone R, Kidd J, Nestel D, Asvall S, Paraskeva P, Darzi A. An innovative model for teaching and learning clinical procedures. *Med Educ* 2002;**36**:628–34.
9 Remmen R, Derese A, Scherpbier A, Denekens J, Hermann I, van der Vleuten C, Van Royen P, Bossaert L. Can medical schools rely on clerkships to train students in basic clinical skills? *Med Educ* 1999;**33**:600–5.
10 Remmen R, Scherpbier A, van der Vleuten C, Denekens J *et al.* Effectiveness of basic clinical skills training programmes: a cross-sectional comparison of four medical schools. *Med Educ* 2001;**35**:121–8.
11 Bradley P, Bligh J. One year's experience with a clinical skills resource centre. *Med Educ* 1999;**33**:114–20.
12 Steiner T, Jünger J, Schmidt J, Bardenheuer H, Kirschfink M, Kadmon M, Schneider G, Seller H, Sonntag HG. HEICUMED: the Heidelberg Curriculum Medicinale – a modular educational programme aiming at a reform of undergraduate medical education according to the new Licensing Act. *Med Ausbild* 2003;**20**:87–91.
13 Nikendei C, Zeuch A, Dieckmann P, Roth C, Schäfer S, Völkl M, Schellberg D, Herzog W, Jünger J. Role-playing for a more realistic technical skills training. *Med Teach* 2004;**27**:122–26.
14 Barrows HS. An overview of the uses of standardized patients for teaching and evaluating clinical skills. *Acad Med* 1993;**68**:443–53.
15 Waas V, Van der Vleuten C, Shatzer J, Roger J. Assessment of clinical competence. *Lancet* 2001;**357**:945–9.
16 Bentler PM. *Maximal reliability for unit-weighted composites.* University of California, Los Angels: UCLA Statistics Preprint no. 405. 2004. http://preprints.stat.ucla.edu/405/MaximalReliabilityforUnitweightedcomposites.pdf
17 Greco M, Brownlea A, McGovern J. Impact of patient feedback on the interpersonal skills of general practice registrars: results of a longitudinal study. *Med Educ* 2001;**35**:748–56.
18 Parikh A, McReelis K, Hodges B. Student feedback in problem based learning. a survey of 103 final year students across five Ontario medical schools. *Med Educ* 2001;**35**:632–6.
19 Roberts J, Norman G. Reliability and learning from the objective structured clinical examination. *Med Educ* 1990;**24**:219–23.

Received 30 July 2004; editorial comments to authors 21 October 2004; accepted for publication 22 February 2005