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- 'docendo ac discendo' - 'by teaching and learning'

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The International Journal of Clinical Skills looks forward to contributing positively towards the training of all members of the healthcare profession.

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Foreword

Head of Clinical Communication King's College London

Since its inception, the International Journal of Clinical Skills (IJOCS) has provided a unique platform for the teaching and learning of clinical skills in a variety of healthcare disciplines. It has become a well established peer reviewed Journal publishing a diverse range of clinical skills articles.

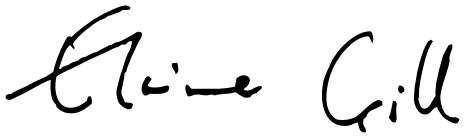
The Editorial Board consists of people active in the field of clinical skills teaching and this is reflected in the journals philosophy to encourage sharing of ideas and practice. Pertinent contributions aim to meet the current needs of researchers and practitioners.

Clinical skills teaching is going through a definite 'growth spurt' at present with increasingly responsive models, manikins and e-learning programmes - not dismissing financial investment that comes along with this. High quality clinical simulation is becoming more sophisticated as a teaching and learning methodology. The need to equip health professionals with the skills and competencies to improve patient-safety is one of the drivers behind this growth. However, alongside the purchase of the 'Sim'-men/women/babies and linked e-learning, let's not forget the importance of personal interactions through faculty support, i.e. experienced clinical teachers. In addition, simulated patients and the delivery of interprofessional sessions, bring clinical simulation closer to the realms of reality and validity, for both undergraduate and postgraduate health professionals.

The use of simulated patients, relatives and carers is well established in clinical communication education. More recently, additional interesting and innovative approaches to clinical communication teaching are in various stages of substantive core curricula and special study activity across medical schools in the UK.

The IJOCS is now established in the world of clinical skills publications by providing a niche specific arena that welcomes quality research, thereby promoting excellence in healthcare internationally. The wide range of papers covering research, discourse and reflection in clinical education and practice, plus the inclusivity of interprofessional approaches in one publication, raises the validity of this journal. There remains room for research based evidence to support teaching and practice of patient-centred clinical learning. The IJOCS welcomes additions to the literature that encourage critical debate.

Without doubt, the International Journal of Clinical Skills has continued to exceed its original ambitions and I wish it growing success.



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Skills days are superior to experiential learning for the development of core procedural skills for foundation trainees

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Keywords:
Procedure
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Abstract

Background: The effectiveness of a clinical skills course undertaken by doctors in the first four weeks of Foundation Year 1 and 2 (F1 & F2) postgraduate training was evaluated.

Methods: Participants completed multiple choice question papers and Likert surveys of perceived competence before, at the end of, and two months after clinical skills courses. For comparison, a group of F2 doctors, who had their skills training two months after the study group, undertook pre-course assessment.

Results: ***Multiple Choice Questions (MCQ);*** The mean MCQ scores of both groups showed significant improvement following the course; F1 doctors (n = 22) from 73.5% to 79.5% (95% CI 2.9 % - 9.2% $p < 0.01$) and F2 doctors (n = 23) from 69.6% to 77.0% (95% CI 4.5% - 10.2% $p < 0.01$). At two months, F2 doctors maintained statistically significant improvement over their pre-training scores ($p = 0.0025$) and over those who had gained experiential learning alone ($p = 0.0152$). ***Competence;*** F2 doctors showed improvement in 5 of 6 skill areas which was sustained at the two month analysis. The experiential learning group had significantly lower reported competence in 2 areas at two months. F1 doctors displayed significant improvements in 3 of 6 skill areas, sustained at two months.

Conclusion: Early clinical skills training offers sustained benefits compared to experiential learning alone.

Introduction

There has long been a culture within medicine of "learning by doing". We expect that junior doctors will gain competence in core procedural skills through their exposure to these activities during their day to day work. It has been shown that there is a correlation between trainee confidence in carrying out clinical procedures and experience, and that this is most significant in the first postgraduate year [1]. This experiential model of learning is dependent upon consistent exposure to procedures and a sufficient number of people competent to teach them.

Several studies have highlighted that the experience of procedural skills gained in the first postgraduate year is highly variable [2]. This is not a new problem; a study of UK doctors in 2003 who had completed their first postgraduate year, found that only 47.9% reported that they had gained a wide experience of clinical procedures during this year [3]. A study from New Zealand showed that opportunities to practice procedural skills (except cannulation and arterial blood gases) occurred less often than weekly for first year medical graduates [4]. The enforced reduction in junior doctors working hours, as the European Working Time Directive has become law, means that this problem is likely to become more significant. In the present climate there is also an increasing requirement to demonstrate objectively that junior doctors can perform safely and with a high degree of competence.

This study examines the value of a formal clinical skills course for foundation trainees, i.e. doctors in their first two postgraduate years. It also compares the knowledge and perceived competence gained through experiential learning alone and for foundation trainees who have attended a procedural skills course.

Methods

Clinical skills training

Recruitment of participants was undertaken following receipt of ethical approval from the local hospital research ethics committee. Participants were Foundation Year doctors (first and second postgraduate year) working at St Mary's Hospital in London, UK. This is a busy teaching hospital which is part of Imperial College Healthcare NHS Trust. All Foundation Year One (F1) and Two (F2) doctors were offered a place on a formal procedural skills course held at the clinical skills laboratory. Foundation Year doctors commence their new posts in August and the procedural skills courses take place in August and October.

Our F1 study group included doctors who received clinical skills training within 30 days of starting their F1 posts. F2 doctors were considered as two groups; the study group (Group A) consisted of F2 doctors who undertook formal clinical skills training within 28 days of starting their F2 posts. The 'control' group (Group B) consisted of F2 doctors who did not undertake their clinical skills training day until 57 days after Group A (Figure 1).

Figure 1: A pictorial representation of the study design for F1 and F2 doctors

Study Day:	Day 0		Day 0		Day 57 - 60	
F1 Doctors	Test 1	Clinical skills training	Test 2	Experiential Learning	Test 3	
F2 Doctors Group A	Test 1	Clinical Skills Training	Test 2	Experiential Learning	Test 3	
F2 Doctors Group B	Experiential Learning				Test 1	Clinical Skills Training

F1 doctors were tested before and after their clinical skills training and again after 57 days; F2 doctors in Group A were assessed in the same way. F2 doctors in Group B did not receive clinical skills training until 60 days after Group A. They were assessed immediately before their training.

The procedural skills chosen for the courses were based on procedures contained in the National Foundation Programme Curriculum for each year group and preference of the Programme Directors for each group; as a result the skills taught to the F2 doctors were considerably more complex than those contained in the skills course for F1 doctors (Figure 2).

Figure 2: Clinical skills taught during the skills course for F1 and F2 doctors

Skill	F1 Doctors	F2 Doctors
1	Peripheral cannulation	Lumbar puncture
2	Venepuncture (including blood cultures)	Non-invasive ventilation
3	Peak flow measurement	Seldinger chest drain insertion
4	Arterial blood gas sampling	Argyle chest drain insertion
5	Urinary catheterisation	Arterial blood gas sampling & arterial line insertion
6	Nasogastric tube insertion	Central line insertion
7	Central line insertion	Airway management.

Study design

A two component questionnaire was developed; the first part assessed knowledge about procedural skills using a Multiple Choice Question (MCQ) format; the second part used a Likert scale to assess trainee's perceived competence in carrying out the procedures. All questions related to skills taught during the courses.

The knowledge based questions were largely concerned with indications for the procedure and complications of the procedures taught. Taking the form of a MCQ paper, the questionnaires both had twelve-stem questions with between three to five True/False answers, with a total available score of 59 for F1 doctors and 61 for F2 doctors.

The second part of the questionnaire pertained to perceived competence to carry out a list of clinical procedures. A five-point Likert scale was used to assess this. Guidance for completion was as follows; a rating of **1** means that *"you feel that you are definitely not competent"*, **2** means *"that you have undertaken this procedure but would not feel competent even with supervision"*, **3** means *"competent under supervision"*, **4** means *"competent without supervision"*, **5** means *"able to teach this skill to medical colleagues"*.

Data handling

Participants were invited to complete questionnaires, however, it was made explicit that this was entirely voluntary and there were no adverse consequences should they not wish to participate. The questionnaires did not require the Foundation Year doctors to state their names, however, participants were asked to fill out the last three digits of their GMC number so that comparison could be made between questionnaires completed before and on the two occasions after completion (immediately after and ten weeks after) the skills course.

Likert survey data is reported using median and range given its ordinal nature and MCQ results are reported using mean and standard deviation based on the assumption that data is normally distributed and continuous.

The collected data was further analysed to identify statistically significant benefits in both perceived competence and knowledge scores. Likert survey data was analysed using the Mann Whitney U test for unpaired samples of categorical data. MCQ data was analysed using unpaired T tests for normally distributed continuous data. Calculations were undertaken using PASW v17.0 (IBM plc).

Results

Participants

F1 doctors (n = 22) undertook the questionnaire immediately before and after the course and also at 60 days after the clinical skills training. At the 60 day follow-up, 13 of the doctors were available and consented to take part in the repeat evaluation.

Group A F2 doctors (n = 23) were invited to complete the questionnaire prior to and immediately following the course. After 57 (± 3) days these participants were asked to repeat the same assessment; at the latter stage 9 doctors were followed up.

Group B F2 doctors who undertook the October clinical skills course (n = 14 for perceived competence, and n = 11 for MCQ) acted as an effective control group and so were assessed immediately prior to their clinical skills course.

The above meant that the 57 day follow-up of F2 doctors in our study group (Group A) could be compared directly with those of our control group (Group B) in terms of experience. Figure 1 shows the study outline.

F1 doctors

Results for this MCQ are reported in Table 1. MCQ Performance in the F1 doctors showed a significant improvement from pre-course assessment to post-course with mean MCQ Performance improving from 73.5% to 79.5% (95% CI 2.9 % - 9.2%, $p < 0.01$). At the two month follow-up the F1 participants scored on average 76.5% (95% CI 73.4% to 79.7%), a non-significant improvement over pre-course performance ($p = 0.1797$).

Mean score and standard deviation are reported for performance in pre- and post-course testing, and for the assessment carried out at 60 days post training.

Table 1: F1 doctors performance in a MCQ questionnaire consisting of 59 true or false questions

	Pre-course	Post-course	60 day follow-up
n =	22	22	13
Mean (%)	73.49	79.51	76.50
SD (%)	6.89	5.31	5.22

Figure 3 displays the change in performance over time of the F1 group including the mean (± 95% confidence intervals). Scores achieved pre-course, post-course and at 60 day follow-up are shown.

Figure 3: Mean performance (± 95% confidence interval) of F1 doctors in a 59-part MCQ paper

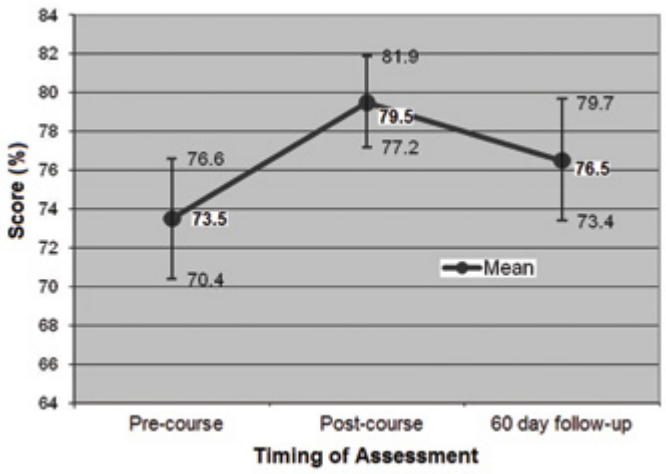


Table 2 describes values reported by participants in the study before and after the course and at the 60 day analysis. Participants were asked to rate their own competence to perform a procedure from **1** *(not even with supervision)*, **3** *(with close supervision)* and **5** *(independent practice and able to teach a medical student)*. 22 F1 participants undertook the questionnaires immediately before (pre-) and immediately after (post-) the clinical skills course. At 60 day follow-up, of the original 22 F1 participants, 13 volunteered for re-assessment.

Table 2: Median (minimum – maximum range) scores for a five-point Likert scale questionnaire of the perceived competence of F1 doctors to undertake the described procedures and the changes related to a clinical skills course

	Pre-course	Post-course	60 day analysis
n =	22	22	13
Cannulation	4 (3-5)	4 (4-5)	4.5 (3-5)
Venepuncture	5 (3-5)	5 (4-5)	5 (4-5)
Arterial Blood Gas	4 (2-5)	4(3-5)	4.5 (3-5)
Nasogastric Tube Insertion	1.5 (1-4)	3 (2-5)	2.5 (1-4)
Urinary Catheterisation	3 (1-5)	4 (3-5)	4 (1-5)
Central Venous Cannulation	1 (1-1)	2 (1-3)	1 (1-3)

The analysis of the Likert survey data (Table 2) revealed that immediately after the course, participants reported significantly improved competence in 4 of 6 skills areas (cannulation, nasogastric tube insertion, urinary catheterisation and central venous cannulation). Of the remaining 2 areas, arterial blood gas measurement showed a trend towards significance and venepuncture was not significant (Table 3).

Table 3: Results of Mann Whitney U testing of F1 doctors reported competence to undertake the procedures described

	Pre-course versus post-course	Pre-course versus 60 day follow-up
COLUMN	A	B
Cannulation	0.047	0.344
Venepuncture	0.678	0.689
Arterial Blood Gas	0.099	0.028
Nasogastric Tube Insertion	<0.001	0.088
Urinary Catheterisation	<0.001	0.021
Central Venous Cannulation	<0.001	0.025

Column A reports change in competence from before to immediately after the course and Column B reports the results of 60 day follow-up when compared to pre course competence.

At the 60 day follow-up, F1 participants recorded significantly increased perceived competence to undertake 3 of the 6 clinical skills: arterial blood gas sampling, urinary catheterisation and central venous cannulation. There was a trend towards significance in nasogastric tube insertion, and in the remaining two areas (cannulation and venepuncture) no significant improvement in perceived competence was demonstrated, as shown in Column B of Table 3.

F2 doctors

The performance of F2 doctors in Group A was assessed identically to the tools utilised for the F1 doctors. In addition, the pre-course scores of Group B were compared directly to the 57 day post-course test scores of Group A using an unpaired T test to determine whether experiential learning alone was inferior to skills training and experiential learning in this population.

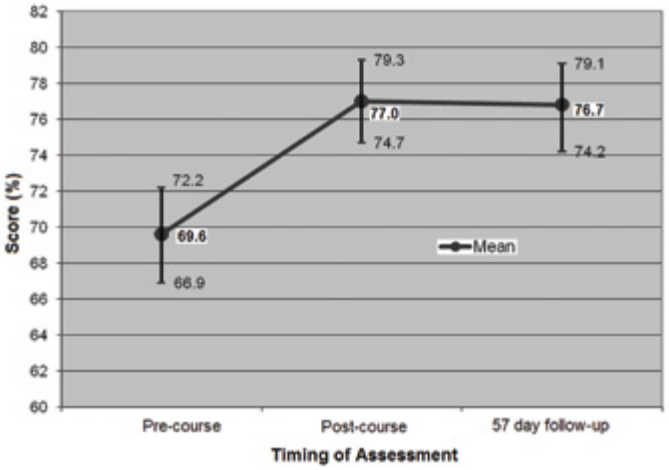
Table 4 reports the results of the MCQ for both Groups A and B at the same time points. Group A doctors improved their MCQ Scores from 69.6% to 77.0% (95% CI 4.5% - 10.2%, $p < 0.01$) from pre- to post-course; and at the 57 day analysis the remaining participants achieved a mean score of 76.7% (95% CI 74.2% - 79.1%). This was a significant improvement over pre-course performance, sustained at the two month stage ($p < 0.01$) (Figure 4).

Table 4: F2 doctors performance in a MCQ questionnaire consisting of 61 true or false questions in Group A (early clinical skills training) and Group B (Experiential Learning)

	Group A			Group B
	Pre-course	Post-course	57 day follow-up	Pre-course
n =	23	23	9	11
Mean (%)	69.57	76.98	76.68	68.92
SD (%)	6.12	5.26	3.16	8.16

Performance of Group A in pre-course, post-course and at 57 day follow-up is reported. Group B's performance at pre-course assessment is shown, undertaken 57 days after Group A had their skills training.

Figure 4: Mean performance (± 95% confidence interval) of F2 doctors in a 61-part MCQ paper (Scores achieved pre-course, post-course and at 57 day follow-up are reported)



When the results of the participants in Group A at the 57 day follow-up stage were compared to those of the pre-course scores of Group B, there was a significant difference in mean MCQ performance with Group B scoring 68.9% (95% CI 63.4% - 74.4%, $p = 0.015$)

Table 5 describes reported competence to undertake the 6 clinical procedures taught during the skills sessions of doctors in Groups A and B. Pre-, post- and 57 day follow-up scores are reported for Group A, as are pre-test score of members of Group B.

Table 5: Median (minimum – maximum range) scores for a five-point Likert scale questionnaire of the perceived competence of F2 doctors to undertake the described procedures and the changes related to a clinical skills course

	Pre-course	Post-course	Two Month Analysis	Experiential Group
n =	23	23	9	14
BiPAP/CPAP Circuit Application	1 (1-3)	3 (1-5)	3 (2-4)	1 (1-3)
Lumbar Puncture	3 (1-4)	3(1-4)	4 (3-4)	3 (1-5)
Seldinger Chest Drain	2 (1-5)	3 (1-5)	3 (2-4)	2 (1-4)
Argyle Chest Drain	1 (1-3)	3 (1-4)	3 (1-4)	1 (1-4)
Arterial Line Insertion	1 (1-4)	3 (1-5)	3 (1-4)	1.5 (1-4)
Arterial Blood Gas	5 (4-5)	5 (4-5)	5 (5-5)	5 (5-5)

Participants were asked to rate their own competence to perform a procedure from 1 (not even with supervision), 3 (with close supervision) and 5 (independent practice and able to teach a medical student). 23 F2 participants undertook the questionnaires immediately before (pre-) and immediately after (post-) the clinical skills course. At 57 day follow-up, of the original 23 F2 participants, 9 volunteered for re-assessment. The experiential group (Group B) records the pre-training scores of those who undertook their clinical skills course 57 days after the 'study' group (Group A).

In assessing perceived competence there were no significant differences between the pre-course scores of Groups A and B in any of the skills (Table 6, Column C). At the post-course analysis, Group A reported significant improvements in perceived competence to undertake 5 of the 6 procedures when compared to their pre-course self assessments (Table 6, Column A). These persisted at 57 day follow-up (Table 6, Column B). When the 57 day follow-up scores of Group A were compared with those of pre-course Group B there was a significant difference in reported competence in 2 skills: Seldinger chest drain insertion ($p = 0.013$) and non-invasive ventilation ($p < 0.001$) (Table 6, Column D).

Table 6: Results of Mann Whitney U testing of F2 doctors reported competence to undertake the procedures described

	Pre-course versus post-course	Pre-course to 57 day follow-up	Baseline comparison of Groups A & B	Group A (training + experience) versus Group B (control) at 57 days
COLUMN	A	B	C	D
BiPAP/ CPAP Circuit Application	<0.001	<0.001	0.876	<0.001
Lumbar Puncture	0.049	0.009	0.229	0.277
Seldinger Chest Drain	0.003	0.007	0.960	0.013
Argyle Chest Drain	<0.001	0.004	0.272	0.092
Arterial Line Insertion	<0.001	0.001	0.229	0.092
Arterial Blood Gas	1.000	0.369	0.263	1.000

Column C describes the baseline similarities of Groups A and B before undergoing clinical skills training. Column A reports changes in perceived competence from before to immediately after the course in Group A, and Column B the changes recorded at 57 day follow-up in the same group. Column D reports the differences between Groups A and B 57 (±3) days after Group A had undertaken skills training and immediately before Group B had their session.

Discussion

Multiple Choice Questions (MCQ)

The performance in the MCQ assessment was significantly better in both groups following the clinical skills training course. In the F2 doctors, this improvement was sustained at the two month follow-up. In F1 doctors there was a trend towards benefit after two months although this did not reach statistical significance ($p = 0.1797$); a larger study would be required to demonstrate this more clearly.

Both F1 and F2 doctors display a significant improvement in knowledge as assessed by MCQ after a clinical skills session. In F1 doctors this improvement was not statistically significant by 60 day follow-up. In F2 doctors, however, there was a sustained benefit at 57 days associated with the training ($p < 0.01$) over baseline (pre-course) performance. When compared to F2 doctors who had received the same amount of experiential learning, but no formal clinical skills training (Group B), participants who had received their training 57 days earlier

performed significantly better, suggesting a benefit in terms of knowledge over experiential learning alone.

Competence

Self reported competence is an adult learning skill and it has been suggested that reported competence may not reflect actual ability [5]. The persistent trends in 11 of the 12 skills assessed at post course and two month analysis, suggests that confidence at least is sustained. As expected, in both groups procedures that the participants should have had considerable exposure to in their training to date scored near maximally (F1: venepuncture, F2: arterial blood gas sampling). This was consistent across the time periods assessed. In addition, the area in which most Foundation Year doctors had minimal experience (central venous cannulation) scored lowest in both F1 and F2 doctors; this suggests that participants were correctly estimating their abilities.

Of the F1 doctors perceived competence assessments, after the course there were significant improvements in 3 of 6 skill areas (nasogastric tube insertion, urinary catheterisation and central venous cannulation). After two months, arterial blood gas sampling had achieved significance whereas prior to the course it did not ($p = 0.028$ vs $p = 0.099$ respectively). This is the only example of an increase in reported competence in either group between the post-course and two month follow-up. This may be due to the considerable clinical familiarity gained by F1 doctors in this procedure during the early phase of their clinical practice.

Compared with experiential learning alone i.e. the pre-test scores of F2 doctors in Group B, there was a significant improvement in perceived competence in 2 skill areas (non-invasive ventilation and Seldinger chest drain insertion) and a trend towards benefit in Argyle chest drain and arterial line insertion. A larger sample size may be required to demonstrate significance here. The 2 clinical skills in which there was no suggested benefit (lumbar puncture and arterial blood gas sampling) are the procedures most commonly undertaken and so extensive clinical exposure may limit the value of specific clinical skills training in procedures of this kind.

Limitations

This study took place in a single centre and so interpretation must be undertaken with caution. However, allocations to UK Foundation Posts are not undertaken at a local level and so participants were effectively drawn from a central 'pool' of Foundation Year doctors. The total number of participants was small in each group, although the sample compares favourably to numbers found in other studies of similar subjects.

The timing of the different clinical skills sessions was fixed and so assessment of the trainees was opportunistic. No participants had their training delayed or altered to facilitate the project. For this reason, the groups were not randomised and so there may be differences between the groups that are undetected. Both F2 groups contained participants undertaking training in primary and secondary care specialties although participants in General Practice attachments were somewhat underrepresented at two month follow-up because they were not accessible for re-assessment within the time window described.

Two of the authors (SL and GT) undertook teaching sessions during the clinical skills training, although every effort was made to standardise information delivered and both authors taught different clinical skills to different groups to minimise any impact.

A further limitation is the number of participants lost to follow-up. Due to clinical commitments, eight F1 and fourteen F2 doctors were not able to complete the follow-up questionnaire. This resulted in a reduced likelihood of achieving statistical significance and the loss of subjects may have resulted in some distortion of the group baseline qualities.

In addition, there may be an effect associated with repeating the same test on a number of occasions. Participants undertaking the two month follow-up may have either deliberately or inadvertently focussed on questions that they had found difficult during the intervening two months, something that Group B participants could not have done.

No baseline test of the participants in Group B was available for comparison with Group A. So whilst it is possible to demonstrate that immediately before the course no significant differences existed between the groups, it would have been beneficial to observe the characteristics of both groups at the same time.

We have not attempted to directly address the question of whether participants were better able to undertake the practical skills after their training. We have used the proxys of knowledge and competence as alternative measures. A further study would be needed to address technical skills improvements in this population.

Conclusion

This small study of the effectiveness of clinical skills training demonstrates for the first time using mixed methods analysis that in junior doctors there is a significant immediate benefit in terms of both knowledge of, and perceived competence to, undertake procedures. This benefit is sustained in F2 doctors at least two months after the training sessions and exceeds improvement resulting from experiential learning alone.

Future directions for investigation could include assessment of whether technical ability to perform procedures is improved following clinical skills training, and a larger scale, multi-centre study should be undertaken to confirm that benefits associated with our study were not a local effect.

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Declarations

The authors have no financial or other interests to declare in relation to this paper.

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