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WJMER

World Journal of Medical Education and Research

An Official Publication of the Education and Research Division of Doctors Academy



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ISSN 2052-1715



The Effect of a Surgical Skills Course on the Self-Evaluated Competency Levels of Medical Students and Junior Doctors: A Prospective Study

Williams RC^{1,2}, Carpenter C^{3,4}, Enoch S²

Institution

¹Cardiff University School of Medicine, Neuadd

Meirionnydd, Heath Park Campus, Cardiff University, Cardiff, CF14 4YS, UK

²Department of Postgraduate Surgical Education, Doctors Academy Group of Educational Establishments, Frazer Building, Cardiff Bay, Cardiff, CF10 5LE, UK

³Consultant Paediatric Trauma and Orthopaedic Surgeon, Noah's Ark Children's Hospital for Wales, University Hospital of Wales, Heath Park Way, Cardiff, CF14 4XW, UK

⁴Training Programme Director for Trauma and Orthopaedics, Health Education and Improvement Wales (HEIW)

Abstract

Purpose: This prospective study examines the effect of a one-day surgical skills course on the self-evaluated competency levels of medical students and junior doctors in essential surgical skills pertinent to their level.

Methods: One hundred and one medical students and junior doctors from various Medical Schools and NHS Foundation Trusts across the UK who attended the 'Essential Surgical Skills and Principles for Aspiring Surgeons (ESSPAS) Course' in May 2021 and October 2022 completed a pre-course and post-course questionnaire on the day of the course. They rated their self-evaluated competency in the skills taught and practised on a Likert scale of '0' to '10'. The mean score for each skill pre-course and post-course was compared. The Wilcoxon signed-rank test was also used to determine if there were any statistically significant changes in attendees' self-evaluated competency levels after the course ($p = <0.05$).

Results: There was a statistically significant increase in participants' self-evaluated competency levels in all skills practised ($p = <0.001$). Additionally, an increase in the mean score after the course was seen across all the 10 domains.

Conclusion: A one-day surgical skills course resulted in a statistically significant improvement in the self-evaluated competency levels of medical students and junior doctors in essential surgical skills pertinent to their level. It has been demonstrated that such courses provide trainees with a strong foundation on which to develop the basic skills required to be competent in the operative theatre. This study has thus evidenced the ability of a short surgical skills course to prepare medical students and junior doctors for clinical practice.

Key Words:

Medical Education; Surgical Education; Surgical Skills; Medical Students; Junior Doctors

Corresponding Author:

Dr Rebecca Charlene Williams; E-mail: WilliamsR58@cardiff.ac.uk

WJMER, Vol 29: Issue 1, 2023

Introduction

The current structure of surgical training in the United Kingdom (UK) places an emphasis on practical courses.^{1,2} They provide surgical trainees with a structured platform through which to develop new technical skills, as well as to practise and enhance their existing abilities. The willingness to attend such courses also allows surgical trainees to demonstrate their commitment to the field of surgery.¹

Simulation is an established and well-regarded tool through which technical and non-technical skills that are essential for healthcare professionals are taught.³ It enables conceptual knowledge to be

integrated with practical ability,⁴ facilitating learning without posing any risk to patients.⁵ A collegial environment that enables a skill to be practiced and feedback to be received allows trainees to develop important expertise and ensures that the skill is learnt correctly.⁶ It can also be argued that practising skills in a simulated environment gives surgical trainees more confidence to attend and assist in theatre, as well as to care for patients.

The broad curriculum implemented by Medical Schools in the UK does not allocate time to teach medical students surgical skills. However, a basic understanding of how to perform skills such as suturing, excising a suspicious skin lesion for biopsy,

and draining an abscess is not specific to surgery; it is required in multiple specialties, from General Practice to Emergency Medicine. Indeed, surgical conditions account for a significant proportion of referrals, both elective and emergency, within the National Health Service (NHS).⁷ The General Medical Council's 'Outcomes for Graduates', which outlines what newly qualified doctors with a primary medical degree from any of the UK's Medical Schools must be able to do as they start their Foundation Training, highlights that newly qualified doctors should be able to scrub, carry out basic wound closure, and administer local anaesthetic under direct supervision.⁸ These skills tend to be taught or revised in surgical skills courses.

The Royal College of Surgeons of England (RCSEng) proposed a 'National Undergraduate Curriculum in Surgery' in 2015 in an attempt to support medical students considering a career in surgery.⁹ This curriculum illustrated the level of surgical competence that those who wish to pursue a career in surgery should aim to attain on completion of Medical School, identifying skills such as the assessment of a wound, the administration of local anaesthetic, the closure of a wound, the safe disposal of sharps, and surgical scrubbing. Since the UK's Medical Schools do not formally teach these surgical skills, those who intend to become surgeons must actively seek opportunities to develop them before or as they become junior doctors. They must, therefore, attend short courses.

RCSEng's report 'Improving Surgical Training', which was also published in 2015, found that general

surgical training could be improved if trainees developed surgical skills at an early stage in their career.¹⁰ As a structured and formal method of instruction, courses inevitably play a fundamental role in surgical trainees' mastery of essential surgical skills and, in turn, their confidence in performing them in clinical practice. This study therefore examines the ability of a short surgical skills course to enhance the self-evaluated competency levels of medical students and junior doctors to perform certain surgical skills.

Methods

This prospective study tested the hypothesis that the self-evaluated competency levels of medical students and junior doctors to perform certain skills improve after they participate in a one-day surgical skills course.

The Essential Surgical Skills and Principles for Aspiring Surgeons (ESSPAS) Course, which was developed in 2017, is aimed at medical students, foundation year doctors, early core surgical trainees, and those working at an equivalent level who are not in the National Training Programme. This annually delivered course intends to provide attendees with an overview of the core concepts, essential principles, and fundamental skills relevant at the level of a foundation year doctor and a core surgical trainee. The course uses animal tissue and simulated models, interspersed with structured and focused presentations delivered by consultant surgeons, to explain and demonstrate a number of essential surgical skills. Attendees practise all of the skills independently. The topics covered in the course are outlined in **Figure 1**.

Topics Covered in the ESPAS Course
<ul style="list-style-type: none"> • Aseptic Precautions in the Operating Theatre • Surgical Gowning and Closed Method of Gloving • Knot Tying (Reef Knot; Surgeon's Knot; Instrument Tie; Tying at Depth; Aberdeen Knot) • Handling Surgical Instruments • Safe and Effective Infiltration of Local Anaesthetic • Basic Suturing Techniques (1): Simple Interrupted and Simple Continuous • Basic Suturing Techniques (2): Vertical Mattress, Horizontal Mattress, and Intradermal • Excision Biopsy of a Cutaneous Pigmented Lesion and Closure of an Ellipse • Removal of a Subcutaneous (Epidermoid) Cyst • Drainage of an Abscess • Debridement of a Contaminated Traumatic Wound • Principles of Wound Healing and Reconstructive Surgery • Role of Antibiotics in Trauma and Surgery • Principles of Surgical Diathermy • Fundamentals of Laparoscopic Surgery

Figure 1: Topics Covered in the ESPAS Course

The ESSPAS Course is delivered by consultant surgeons and surgical registrars. Each course has a high tutor-to-delegate ratio to ensure that attendees receive sufficient support, guidance, and individualised feedback. The skills are demonstrated live and projected onto screens using a visualiser, following which the attendees practise each technique with assistance from the tutors. Didactic presentations on key concepts, such as the principles of reconstructive surgery, are also given. The course is accredited by the College of Physicians and Surgeons of Cardiff.

The participants of this study were those who attended the one-day ESSPAS Course on either 22nd May 2021, 23rd May 2021, 29th October 2022 or 30th October 2022. The data were, therefore, collected at four ESSPAS Courses. The courses were conducted at the International Surgical Education and Training Centre in Cardiff Bay, Cardiff, UK.

A total of 101 individuals attended the ESSPAS Course on these four dates, 40 of whom were medical students and 61 of whom were junior doctors. All the participants were either studying in one of the UK's Medical Schools or working in the UK's NHS. **Table 1** details the year of study or level of training of each participant. **Figure 2** illustrates the distribution of the medical students who attended these courses by the Medical School in which they study. Eighteen of the UK's Medical Schools were represented. **Figure 3** illustrates the distribution of the junior doctors who attended these courses by the region of the NHS in which they work. All seven regions of NHS England, as well as Wales and Northern Ireland, were represented. **Table 2** sets out the hospitals or trusts within those regions in which the participants work.

Year (Medical Student)	Number
Year 2	6
Year 3	11
Year 4	11
Year 5	12
Level (Junior Doctor)	
Foundation Year 1	18
Foundation Year 2	20
Foundation Year 3	1
Specialty Trainee 3	1
Trust Grade Doctor	21

Table 1: Level of Attendees of the ESSPAS Courses in May 2021 and October 2022

Distribution of Medical Students who Attended the ESSPAS Courses in May 2021 and October 2022 by Medical School

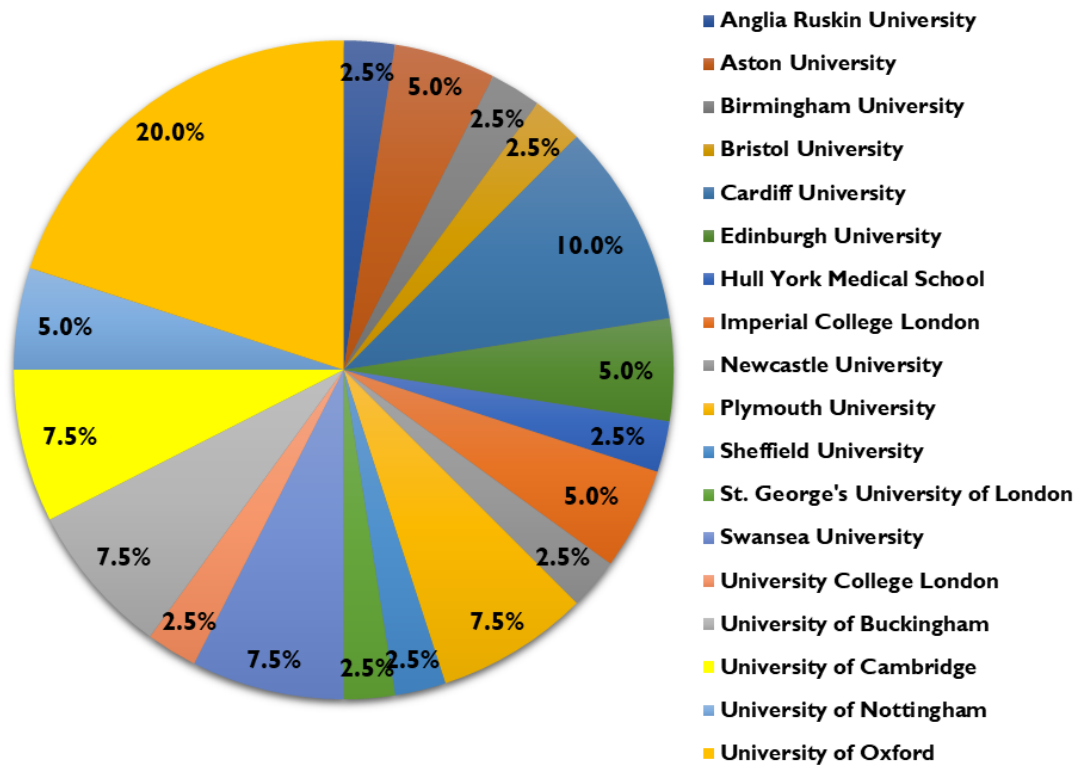


Figure 2: Distribution of Medical Students who Attended the ESSPAS Courses in May 2021 and October 2022 by Medical School

Distribution of Junior Doctors who Attended the ESSPAS Courses in May 2021 and October 2022 by Regions of the NHS

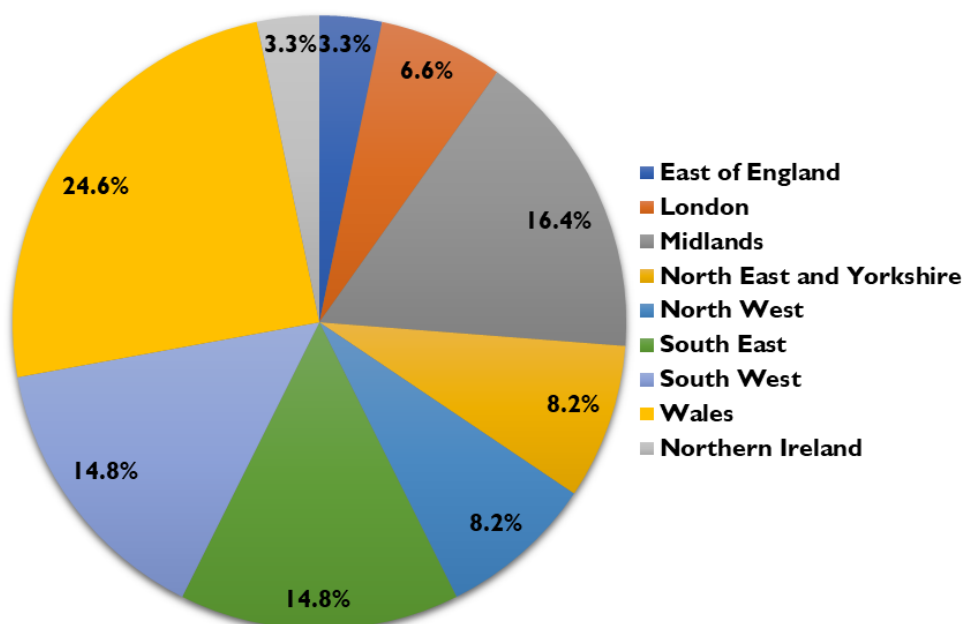


Figure 3: Distribution of Junior Doctors who Attended the ESSPAS Courses in May 2021 and October 2022 by Regions of the NHS

Region of the NHS	NHS Hospital or Trust
East of England	<ul style="list-style-type: none"> Lister Hospital, Stevenage
London	<ul style="list-style-type: none"> North Middlesex University Hospital NHS Trust Royal Free London NHS Foundation Trust St. Mary's Hospital, London
Midlands	<ul style="list-style-type: none"> King's Mill Hospital, Sutton-in-Ashfield Leicester Royal Infirmary, Leicester Queen Elizabeth Hospital Birmingham, Birmingham Sandwell and West Birmingham Hospitals NHS Trust Shrewsbury and Telford Hospital NHS Trust Worcestershire Acute Hospital NHS Trust University Hospitals Coventry and Warwickshire NHS Trust University Hospitals of Derby and Burton NHS Foundation Trust
North East and Yorkshire	<ul style="list-style-type: none"> Airedale NHS Foundation Trust Bradford Teaching Hospitals NHS Foundation Trust County Durham and Darlington NHS Foundation Trust Leeds Teaching Hospitals NHS Trust
North West	<ul style="list-style-type: none"> Aintree University Hospital, Liverpool Manchester Royal Infirmary, Manchester St. Helen's and Knowsley Teaching Hospitals NHS Trust Warrington and Halton NHS Foundation Trust Wirral University Teaching Hospital NHS Foundation Trust
South East	<ul style="list-style-type: none"> Ashford and St. Peter's Hospitals NHS Foundation Trust East Kent Hospitals University NHS Foundation Trust Oxford University Hospitals NHS Foundation Trust University Hospital Southampton NHS Foundation Trust
South West	<ul style="list-style-type: none"> Musgrove Park Hospital, Taunton Poole Hospital NHS Foundation Trust Royal Cornwall Hospitals NHS Trust Royal United Hospitals Bath NHS Foundation Trust Southmead Hospital, Bristol
Wales	<ul style="list-style-type: none"> Bronglais General Hospital, Aberystwyth Cwm Taf Morgannwg University Health Board Grange University Hospital, Cwmbran Morriston Hospital, Swansea Royal Gwent Hospital, Newport University Hospital of Wales, Cardiff Withybush General Hospital, Haverfordwest
Northern Ireland	<ul style="list-style-type: none"> Belfast Health and Social Care Trust

Table 2: NHS Hospitals and Trusts in which Junior Doctors who Attended the ESSPAS Courses in May 2021 and October 2022 Work

Each attendee was asked to complete a pre-course and a post-course questionnaire at the course. They were required to rate their self-evaluated competency in 10 skills taught at the course on an 11-point Likert scale (0-10). Each attendee was randomly assigned a number to allow the researchers to match his/her pre-course responses with his/her post-course responses. The responses were, therefore, anonymous. Data were collected and analysed from all 101 attendees. Informed consent was obtained. Ethical approval had been granted by Doctors Academy Academic Research Ethics Committee (DAAREC) (No:2021SS02).

IBM SPSS Version 28 was used to analyse the data.

The Wilcoxon signed-rank test was used to determine if there were any statistically significant changes in attendees' self-evaluated competency levels after the course. The level of statistical significance was set at 5% ($p = <0.05$).

Results

Participants rated 10 items on a scale of 0 to 10: 0 indicated no self-evaluated competency, and 10 indicated complete self-evaluated competency. Improvements in self-evaluated competency levels after the course were present in all 10 items. **Table 3** presents the mean score for each skill in the pre-course questionnaire and the post-course questionnaire.

Skill	Pre-Course Score (Mean)	Pre-Course Score (SD)	Post-Course Score (Mean)	Post-Course Score (SD)
Surgical Gowning and Closed Method of Gloving	6.71	2.238	9.04	0.916
Knot Tying (Reef Knot; Surgeon's Knot; Instrument Tie; Tying at Depth; Aberdeen Knot)	4.85	2.032	8.19	1.206
Basic Suturing Techniques (1): Simple Interrupted and Simple Continuous	5.37	2.043	8.43	1.134
Basic Suturing Techniques (2): Vertical Mattress, Horizontal Mattress, and Intradermal	3.89	2.059	7.99	1.315
Safe and Effective Infiltration of Local Anaesthetic	5.46	2.468	8.42	1.314
Excision Biopsy of a Cutaneous Pigmented Lesion and Closure of an Ellipse	3.64	2.129	7.90	1.368
Removal of a Subcutaneous (Epidermoid) Cyst and Drainage of an Abscess	3.50	2.279	7.92	1.254
Debridement of a Contaminated Traumatic Wound	3.46	2.076	7.87	1.246
Principles of Surgical Diathermy	3.17	1.995	7.70	1.331
Fundamentals of Laparoscopic Surgery	3.03	1.884	7.31	1.580

Table 3: Mean Scores on Pre- and Post-Course Questionnaire for ESSPAS Courses in May 2021 and October 2022

Table 3 illustrates that an increase in the mean score after the course was seen in all 10 skills: Surgical Gowning and Closed Method of Gloving (+2.33); Knot Tying [Reef Knot; Surgeon's Knot; Instrument Tie; Tying at Depth; Aberdeen Knot] (+3.34); Basic Suturing Techniques (1): Simple Interrupted and Simple Continuous (+3.06); Basic Suturing Techniques (2): Vertical Mattress, Horizontal Mattress, and Intradermal (+4.10); Safe and Effective Infiltration of Local Anaesthetic (+2.96); Excision Biopsy of a Cutaneous Pigmented Lesion and Closure of an Ellipse (+4.26); Removal of a Subcutaneous (Epidermoid) Cyst and Drainage of an Abscess (+4.42); Debridement of a Contaminated Traumatic Wound (+4.41); Principles of Surgical Diathermy (+4.53); and Fundamentals of Laparoscopic Surgery (+4.28).

The Wilcoxon signed-rank test showed that this one-day course elicited a statistically significant difference in the self-evaluated competency levels of medical students and junior doctors to perform certain surgical skills ($p = <0.001$ for all 10 items). **Table 4** provides the z-scores and p values of the Wilcoxon signed-rank test.

The ranks that the Wilcoxon signed-rank test produced reveal interesting data about participants' self-evaluated competency levels in certain skills before and after the ESSPAS Course. **Table 5** outlines the number of participants who reported a higher self-evaluated competency level, a lower self-evaluated competency level, and no change in level of self-evaluated competency in each skill following the course.

Skill	Z-Score	P Value
Surgical Gowning and Closed Method of Gloving	-8.249	<0.001
Knot Tying (Reef Knot; Surgeon's Knot; Instrument Tie; Tying at Depth; Aberdeen Knot)	-8.671	<0.001
Basic Suturing Techniques (1): Simple Interrupted and Simple Continuous	-8.409	<0.001
Basic Suturing Techniques (2): Vertical Mattress, Horizontal Mattress, and Intradermal	-8.640	<0.001
Safe and Effective Infiltration of Local Anaesthetic	-8.091	<0.001
Excision Biopsy of a Cutaneous Pigmented Lesion and Closure of an Ellipse	-8.672	<0.001
Removal of a Subcutaneous (Epidermoid) Cyst and Drainage of an Abscess	-8.582	<0.001
Debridement of a Contaminated Traumatic Wound	-8.496	<0.001
Principles of Surgical Diathermy	-8.663	<0.001
Fundamentals of Laparoscopic Surgery	-8.534	<0.001

Table 4: Results of Wilcoxon Signed-Rank Test

Skill	No. of Participants with a Lower Post-Course Score	No. of Participants with a Higher Post-Course Score	No. of Participants with No Change
Surgical Gowning and Closed Method of Gloving	0	89	12
Knot Tying (Reef Knot; Surgeon's Knot; Instrument Tie; Tying at Depth; Aberdeen Knot)	0	99	2
Basic Suturing Techniques (1): Simple Interrupted and Simple Continuous	0	93	8
Basic Suturing Techniques (2): Vertical Mattress, Horizontal Mattress, and Intradermal	0	98	3
Safe and Effective Infiltration of Local Anaesthetic	1	87	13
Excision Biopsy of a Cutaneous Pigmented Lesion and Closure of an Ellipse	0	99	2
Removal of a Subcutaneous (Epidermoid) Cyst and Drainage of an Abscess	0	97	4
Debridement of a Contaminated Traumatic Wound	0	95	6
Principles of Surgical Diathermy	0	99	2
Fundamentals of Laparoscopic Surgery	0	96	5

Table 5: Table of Ranks for ESSPAS Courses in May 2021 and October 2022

Discussion

A statistically significant difference in attendees' self-evaluated competency levels before and after the ESSPAS Course was noted for every skill about which participants were asked, including those that are outlined in the GMC's 'Outcomes for Graduates' and RCSEng's 'National Undergraduate Curriculum in Surgery'.^{8,9} That the majority of participants reported increased self-evaluated competency in each skill following the course evidences the ability of a short surgical skills course to contribute to medical students' and junior doctors' preparation for clinical practice. The results of this study support the assertion that such experimental learning helps trainees to advance their skills and, therefore, contributes to safe and accurate patient care.¹¹

The ability to effectively and efficiently knot tie and suture is a fundamental aptitude that all surgical trainees must possess. Indeed, the closure of a wound is outlined in the GMC's 'Outcomes for Graduates' as a skill that all newly qualified doctors should be able to perform.⁸ The fact that almost all the attendees rated their self-evaluated competency in knot tying and various types of suturing higher after the course emphasises the capability of short surgical skills courses to help individuals to harness important skills that will be essential for their

career, regardless of the specialty they choose. If an individual's confidence is enhanced after he/she has undertaken a surgical skills course, he/she will arguably feel more assured to perform, or at least assist in, this skill in real clinical practice. This should prompt him/her to maximise the opportunities presented to him/her and to, therefore, progress in his/her career.

It is particularly noteworthy that, whilst the attendees rated their competency the lowest in principles of surgical diathermy and fundamentals of laparoscopic surgery at the beginning of the course, their self-evaluated competency in these two skills had significantly increased at the end of the course to match their self-evaluated competency in the other skills encountered. In fact, the increase between the mean pre-course score and post-course score for principles of surgical diathermy was the greatest of all the skills. Whilst medical students and junior doctors often observe surgical diathermy being used in the operating theatre, they typically do not control it, and they might not have a sound understanding of how it functions or the dangers associated with it. Additionally, they might not appreciate the complexity of laparoscopic surgery and the skills that a laparoscopic surgeon must possess, such as hand-eye coordination, depth perception and dexterity. Yet, if they use a

laparoscopic simulator to carry out simulated exercises in a simulated environment, they are able to acknowledge the technical aptitude that is required to operate laparoscopically. The results of this study therefore reveal that, through providing an insight into how common operative technologies function, surgical skills courses can enhance attendees' familiarity and confidence with them and, in turn, strengthen how proficient they feel.

It is worthy of note that the self-evaluated competency of one participant in the infiltration of local anaesthetic decreased after the course. While the results of this quantitative research do not explicate the reason for this, it is plausible that, after having practised this skill in a simulated environment, this participant realised that he/she was not as competent as he/she originally thought. It must be highlighted that short surgical skills courses do not create a fully competent surgical trainee. Attendees are taught new skills and provided with a platform on which to refine their existing skills, but they must continue to practise after the course, as well as acquire experience in a real clinical environment, to attain complete proficiency. The ESSPAS Course has a high faculty-to-delegate ratio, and the faculty confirm that every attendee is able to perform each simulated skill. If an attendee struggles, a member of the faculty will offer additional support to ensure that he/she is able to complete the exercise. While this participant would have demonstrated the ability to infiltrate local anaesthetic on animal tissue at the course, he/she recognised that more practice is required in order for him/her to feel competent to perform this procedure on a patient. The acts of thought and reflection are the cornerstone of effective teaching practice.¹² If such surgical skills courses can encourage learners to reflect on the skills with which they require help to develop, trainees can work on those skills and therefore progress in their surgical careers.

It is perhaps not unexpected that the self-evaluated competency level of 12 participants in surgical gowning and gloving did not alter significantly after the course. Medical students and, particularly, junior doctors often gown and glove in order to enter theatre, and many will arguably feel proficient in this exercise. However, it remains essential to discuss this fundamental element of surgical practice in such a course. Indeed, some medical students would not yet have had the opportunity to scrub, gown and glove, and certain junior doctors might lack confidence in certain steps.

Those who attended the ESSPAS Course might observe the surgical procedures simulated at the course in the operating theatre, such as the

debridement of a contaminated traumatic wound, but they would not necessarily be permitted to independently perform such procedures themselves at their level of training. This study does not intend to suggest that those who attend a short surgical skills course are able to independently carry out each skill practised in a real clinical environment. However, it does argue that, now that they have attempted to perform a simulated version on animal tissue, they can appreciate the procedures and their complexities, which makes them more confident in assisting their seniors to conduct these surgical procedures. Indeed, it has been indicated that attending a surgical skills course prior to a surgical placement can maximise the educational benefit that medical students gain from that placement.¹³ Their development of basic skills before the placement can increase their confidence which, in turn, allows them to maximise their learning opportunities.¹³ We can also apply this principle to junior doctors before their rotations in certain surgical specialties.

A limitation of this study is that it is centred on the perceptions of medical students and junior doctors, which are subjective; one individual's definition of 'competent' might not mirror another individual's definition of the concept. It should also be highlighted that there was a potential selection bias of the participants. The participants were self-motivated medical students and junior doctors who voluntarily chose to attend a non-mandatory surgical skills course on a weekend. They were, therefore, arguably rather incentivised to become more competent in performing the surgical skills practised at the course. However, this does not undermine the evidence outlined above that short surgical skills courses have the ability to enhance medical students' and junior doctors' self-evaluated proficiency in fundamental surgical skills.

Conclusion

This study examined if a one-day surgical skills course can enhance the self-evaluated competency of medical students and junior doctors to perform certain essential surgical skills. It found that the majority of participants experienced an increase in their self-evaluated competency levels after the course in every skill about which they were asked. This study has thus evidenced the ability of a short surgical skills course to prepare medical students and junior doctors for clinical practice. That reference is made to some of these skills in the GMC's 'Outcomes for Graduates' and RCEng's 'National Undergraduate Curriculum in Surgery' highlights the relevance of such courses in surgical trainees' development.

It is important to highlight that a short surgical skills course does not produce a fully competent surgeon;

this competency is attained through exposure in the operating theatre, practice, and experience. However, as the results of this study have revealed, such courses can help medical students and junior doctors enhance their skills, which will arguably be beneficial to patient care.

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An Official Publication of the Education and Research Division of Doctors Academy

