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Participants' opinions of laparoscopic training devices after a basic laparoscopic training course

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Abstract

Background: Basic laparoscopic skills are initially best taught and practiced in an inanimate setting. Various devices are used to aid in this education of laparoscopic skills. These devices range from simple box trainers to sophisticated virtual reality trainers. This investigation tested the hypothesis that participants would prefer one trainer to another trainer.

Methods: Preclinical medical students volunteered for this study. All underwent a porcine laboratory. The students were then divided into 3 groups by method of training: group A—a virtual reality trainer (MIST-VR), group B—an inanimate box trainer (LTS 2000), and group C—both trainers. Each group participated in 10 laboratories with the assigned trainer(s). After completion of the laboratories, all students underwent a similar porcine laboratory. During this laboratory, opinions of each trainer and specific tasks were ascertained from each student.

Results: No statistical difference was seen between groups A and B when asked if their specific trainer helped their skills, was realistic, helped in the animal laboratory, and was interesting. When group C was asked the same questions about each trainer, no statistical difference was seen except that 47% thought the MIST-VR was not realistic as opposed to 0% who thought the LTS 2000 was not realistic ($P < .003$). The level of difficulty of each task correlated with how much the specific task helped in development of skills for both trainers ($P < .0001$). In group C, 89% of the participants thought the LTS 2000 helped more that the MIST-VR and 56% thought the LTS 2000 was more interesting than the MIST-VR. In addition, 83% of students in group C chose LTS 2000 when asked to pick only one trainer.

Conclusions: While virtual reality trainers may have some advantages, most participants feel that inanimate box trainers help more, are more interesting, and should be chosen over virtual reality trainers if only one trainer is allowed. Further studies need to investigate if the opinions affect participants' utilization of these trainers.

Keywords: Laparoscopy; Training; Virtual reality; Education

Laparoscopic surgery requires specialized dexterity different than open surgery due to translation of a 2-dimensional video image into a 3-dimensional working area, decreased tactile feedback, varied eye-hand coordination, and the fulcrum effect [1–3]. These issues make training in laparoscopic skills more difficult especially since it has been demonstrated that possession of open skills does not guarantee of possession of laparoscopic skills [2].

Thus basic laparoscopic skills should be initially taught in an inanimate training laboratory [4–6] While inanimate laboratories may have little maintenance cost, setup costs for the equipment can be high. Virtual reality trainers and inanimate box trainers are two types of trainers we recommend for basic skills laboratories [1]. Both devices have advantages and disadvantages, which give multiple avenues to train laparoscopic skills. The main virtual reality trainer that has been appropriately validated in the literature is the Minimally Invasive Surgery Trainer-Virtual Reality (MIST-VR; Medical Education Technologies, Inc., Sarasota, FL) [7]. One type of inanimate box training device is the Lapa-

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Table 1
MIST-VR and LTS 2000 tasks

MIST-VR	LTS 2000
Acquire and place	Place pegs on a pegboard
Transfer and place	Transfer peg from one hand to another and then on pegboard
Transversal	Cannulate a pipe cleaner through a pipe
Withdraw and insert	Place probe through 3 different colored rings
Diathermy	Progress on a piece of a rope
Manipulate and diathermy	

roscopic Training Simulator (LTS 2000; Realsim Systems, LLC, Albuquerque, NM), which has been described in successfully educating residents [6]. These devices do vary in cost. It has been suggested that the initial cost may be offset by the decrease in operating time during training [8].

The advantages and disadvantages of both trainers need to be explored. For example, while the inanimate box trainers include the lack of automated recording of performance, the MIST-VR allows retrieval of these data with much ease. Full evaluation of these devices is necessary, including participants' opinion of them. This study has tested the hypothesis that participants would show some favoritism towards either the box trainer or the virtual reality trainer.

Materials and Methods

This study was performed at Rush University. Preclinical medical students volunteered for this study. All underwent a porcine laboratory session to get acquainted with basic laparoscopic tasks. After this session, the students were divided into 3 groups of training: group A—virtual reality training, group B—inanimate box training, and group C–both types of training. The virtual reality training useded the MIST-VR; the inanimate box training used the LTS 2000.

Each group spent similar time in the laboratory with their assigned trainers. The training included 10 sessions, 20 minutes each. Table 1 demonstrates the tasks performed on the MIST-VR and LTS 2000, respectively. After completion of all the laboratories, the students underwent another session in the animate porcine laboratory. The tasks were placing a stapler on the bowel, running the bowel, placing a piece of bowel in a bag, and taking a liver biopsy. During this laboratory, opinions of each trainer and utility of specific skills were ascertained from each student. Each group completed a separate survey. Appendix 1 demonstrates the survey given to group C. Similar surveys were tailored for each group. The term "interesting" was told to the students to mean that the training device was interesting enough to keep their interest during training. Incomplete responses were not included in the analysis. Statistical analysis included χ^2 tests and Spearman correlations (GraphPad InStat Version 3.05, San Diego, CA).

Table 2
Group A (MIST-VR) versus group B (LTS 2000) responses

	Group A	Group B	P
Trainer helped skills	89%	100%	NS
Trainer not realistic enough	53%	36%	NS
Trainer helped in animal lab	87%	93%	NS
Tasks on trainer were interesting	83%	86%	NS

NS = not significant.

Results

There were 50 students in our study period. Group A had 18 students, group B had 14 students, and group C had 18 students. When comparing group A and group B, there were no statistical differences when asked if the respective trainer helped with skills, was realistic, helped them in the laboratory, or was interesting (Table 2). When group C was asked the same question about each trainer, no statistical difference was seen except that 40% of group C thought the MIST-VR was not realistic as opposed to 0% when asked about the LTS 2000 (Table 3), Further responses of groups A, B, and C are displayed in Tables 4 and 5.

In addition, group C was asked questions directly comparing both trainers. In group C, 89% of the participants thought the LTS 2000 helped more than the MIST-VR. In addition, 56% of the students thought the LTS 2000 was more interesting than the MIST-VR. Finally, 83% of these students would choose the LTS 2000 when asked which trainer they would pick if they were only allowed to use one.

Correlations were calculated between the level of difficulty of each task and how much the students felt the specific tasks helped in the development of skills. Both the MIST-VR (Fig. 1) and the LTS 2000 (Fig. 2) demonstrated a positive correlation between level of difficulty and level of help in skill development.

Comments

While virtual reality trainers may have some advantages, participants feel that inanimate box trainers helped more, are more interesting, and should be chosen over virtual reality trainers if only one trainer is allowed. While these results are surprising, the study does have some obvious limitations. One is this is a survey study with all the associated limitations. The self-reported answers may change

Table 3
Group C responses

	MIST-VR	LTS 2000	P
Trainer helped skills	94%	100%	NS
Trainer not realistic enough	47%	0%	<.003
Trainer helped in animal lab	88%	100%	NS
Tasks on trainer were interesting	94%	100%	NS

Table 4
Group A and B responses about MIST-VR and LTS 2000 tasks

	Level difficulty	Helped develop skills
Group A		
Acquire place	1.8	5.3
Transfer place	2.4	6.1
Transversal	3.8	7.0
Withdraw & insert	2.7	5.4
Diathermy	4.3	6.7
Manipulate & diathermy	7.6	7.9
Group B		
Place peg	4.4	7.3
Transfer peg	7.0	7.8
Duct cannulation	3.3	5.2
Ring exercise	1.9	2.9
Rope	2.9	7.2

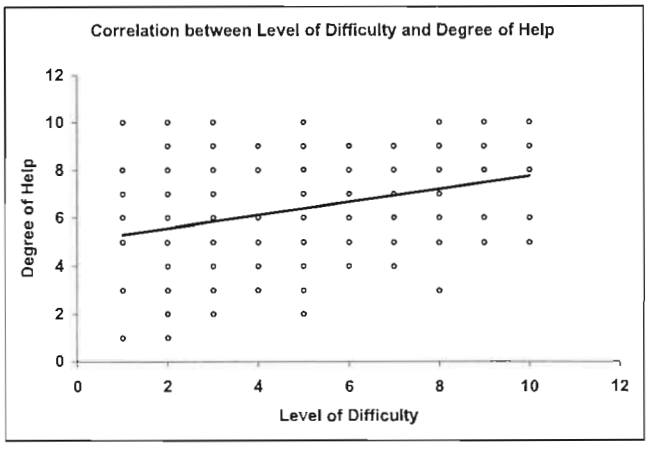

Fig. 1. MIST-VR tasks.

over time as participants use trainers more and/or gain more experience in laparoscopy. Also, all of our participants were preclinical medical students. Although they were able to go into a laparoscopic inanimate laboratory, it is unknown if their relative inexperience influenced part of their opinions.

In addition, our initial training session could have biased our results. We used this session to introduce laparoscopy to the students since they had no clinical experience. We do not believe that the porcine tasks biased the students towards the MIST or the LTS, although this is a possibility. Unfortunately, we did not look at performance in this study. If performance had been recorded, a correlation could have been evaluated.

Despite these limitations, this study does provide some data to suggest that simple virtual reality trainers do not generate the same amount of interest as simple box trainers, especially in the inexperienced. Does this mean that virtual reality trainers need to be made more realistic? Or do our data suggest the mundane learning of basic laparoscopy skills is analogous to learning scales before a song when playing instrument? It would have been valuable to ask group C why they thought the box trainer was more realistic, interesting, and helpful. Unfortunately, we did not.

It is possible that these opinions do affect participant utilization of these trainers, although we did not test this. While our study demonstrates that many students may not view virtual reality trainers as realistic, it is well established in the literature that virtual reality training is successful in educating laparoscopic basic training skills [7]. Again if we tested more experienced surgeons, we may find different results compared to our study. It should be noted the virtual reality trainers are primitive at this time. Thus, this may account for the lack of interest by students. On the other hand, the MIST-VR's objective assessment of skill is of importance when training and to help document competence.

An appropriate basic laparoscopic skills laboratory should have both inanimate and virtual reality trainers since each trainer provides certain advantages and disadvantages [1]. Since the students find the box trainers more realistic as well as helpful and since the literature demonstrates the effectiveness of virtual reality trainers, we feel it is imperative to have both trainers in a laboratory setting.

Table 5
Group C responses about MIST-VR and LTS 2000 tasks

	Level difficulty	Helped develop skills
MIST-VR		
Acquire place	2.9	5.2
Transfer place	3.5	5.9
Transversal	5.4	6.0
Withdraw & insert	4.6	5.7
Diathermy	5.6	6.4
Manipulate & diathermy	8.4	7.3
LTS 2000		
Place peg	4.8	6.6
Transfer peg	7.1	7.7
Duct cannulation	3.6	4.6
Ring exercise	2.6	3.1
Rope	4.2	6.4

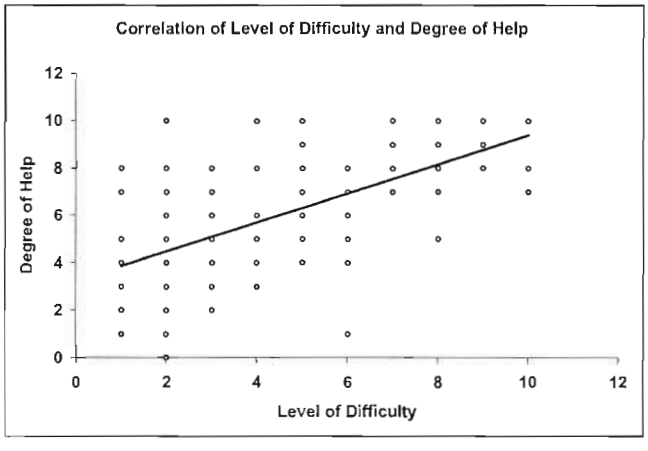

Fig. 2. LTS-2000 tasks.

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Appendix 1

Group C questionnaire

Name:_____

The MIST helped my laparoscopic skills.	True	False
The MIST was not realistic enough.	True	False
The MIST tasks helped me perform better on the tasks in the animal lab.	True	False
The tasks on the MIST were interesting.	True	False

On a scale of 1 to 10 please rate each task in level of difficulty:

Task 1: (Acquire place) _____
Task 2: (Transfer place) _____
Task 3: (Transversal) _____
Task 4: (Withdraw & insert) _____
Task 5: (Diathermy) _____
Task 6: (Manipulate & diathermy)_____

On scale of 1 to 10 please rate each task in helping develop your laparoscopic skills:

Task 1: (Acquire place) _____
Task 2: (Transfer place) _____
Task 3: (Transversal) _____
Task 4: (Withdraw & insert) _____
Task 5: (Diathermy) _____
Task 6: (Manipulate & diathermy)_____

Comments:

Group C Questionnaire:

The LTS helped my laparoscopic skills.	True	False
The LTS was not realistic enough.	True	False
The LTS tasks helped me perform better on the tasks in the animal lab.	True	False
The tasks on the LTS were interesting.	True	False

On a scale of 1 to 10 please rate each task in level of difficulty:

Task 1: (Place peg) _____
Task 2: (Transfer peg) _____
Task 3: (Duct cannulation)_____
Task 4: (Ring exercise) _____
Task 5: (Rope) _____

On scale of 1 to 10 please rate each task in helping develop your laparoscopic skills:

Task 1: (Place peg) _____
Task 2: (Transfer peg) _____
Task 3: (Duct cannulation)_____
Task 4: (Ring exercise) _____
Task 5: (Rope) _____

Comments:

Which trainer helped develop your laparoscopic skills more?	LTS	MIST Same
Which trainer was more interesting?	LTS	MIST Same
If you could only do one trainer, which one would you do?	LTS	MIST

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