## **ORIGINAL RESEARCH**



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# Comparing the effectiveness of self-directed video tour versus an attending-led tour in Pediatric Emergency Department Orientation

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#### ABSTRACT

**Objectives:** Providing a tour of an Emergency Department to medical trainees as part of their pediatric emergency medicine clerkship orientation is important in order to teach significant location and safety features. For many years, we provided an attending-led tour, but increased faculty demands on faculty time prompted us to develop a self-directed video-based tour to replace the attending-led tour. This study compares the learning effectiveness between the two methods.

**Methods:** A single-site quasi-experimental design study was conducted to assess knowledge acquisition and satisfaction of medical trainees between two instructional methods (an attending-led tour and a self-directed video-based tour). Groups were assigned an attending-led or self-directed video tour covering identical content. Trainees completed post-tour knowledge acquisition and satisfaction surveys. Mann–Whitney *U* tests were used for group comparisons of the knowledge acquisition and satisfaction total scores. Spearman correlations were used to look for a relationship between the knowledge acquisition and satisfaction scores. Chi-square and Fisher's exact tests were used to compare groups on categorical variables.

**Results:** A total of 62 subjects were enrolled; 31 participated in an attending-led tour, and 31 in a video tour. The knowledge acquisition survey (median score 12 vs. 11, p = 0.021) favored the attending-led tour. Total scores for the five-point satisfaction (median score 47 vs. 40, p = 0.001) and collapsed three-point satisfaction surveys (median score 30 vs. 29, p = 0.008) also favored the attending-led tour.

**Conclusions:** Although medical trainees favored the attending-led tour over the video tour, the difference was not significant enough to justify terminating the video tour. We believe that this first-time implementation of a self-directed video-based tour is novel. After making further design improvements, we will continue to investigate its plausibility, since it has potential to augment in-person teaching time for educational faculty.

### Introduction

Medical training programs provide orientations for residents and students on clerkship rotations. This training lays a foundation for expectations related to performance and to facility- and department-specific operations, policies, procedures, and processes. In fact, this training falls within the Occupational Safety and Health Administration requirements that employers provide job-relevant workplace safety training at the employee's initial assignment (https:// www.osha.gov/). Furthermore, providing clerkship orientations has been associated with reduced trainee stress and improved rotation satisfaction, as well as the clarification of clerkship tasks, roles, and expectations [1]. As medical educators, we recognize the value of providing orientation to prepare

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learners to reach their potential to perform the job and expected tasks satisfactorily from day 1. While proper orientation fuels learners' enthusiasm to get "up to speed" quickly, it also helps to reduce anxiety that may arise from entering an unknown situation.

The orientation delivery method and format may vary based on the nature of the program. The most common delivery methods and formats include emails, videos, checklists, customized orientation kits (welcome letter, handbook, brochures, list of the key people and amenities, etc.), web-based virtual orientation or online resources, and live tours. Among these, providing a tour is a popular method used by many medical institutions to allow trainees to get to know the work areas, as well as reduce anxiety regarding safety issues. Our pediatric emergency clerkship has been using an attending-led guided tour for many years to orient trainees to the facility and educate them about significant safety features. In our pediatric emergency medicine (PEM) clerkship, visiting residents and medical students participate in a three-part orientation process. First, trainees receive a pre-rotation introductory email instructing them on how to access preparatory content via the institution's online education portal, to be reviewed prior to their orientation day. Second, on the day of their first shift, they receive electronic medical record training. Third, they receive an onsite emergency department (ED) tour. The tour orients the trainees to the location of patient rooms, charting and equipment areas, soiled utility areas for used instruments, and nursing pod stations. The tour also includes instruction on safety features such as fire alarm pulls, fire extinguishers, safety data sheets, a personal protective equipment cart (masks, gowns, and eye protection), and ED Disaster Manuals.

The PEM clerkship receives visiting residents and medical students at the beginning or end of each month. Due to schedule variation, however, the trainees do not always begin their rotation on the same date. Consequently, the PEM faculty members must attend on each "orientation day" and sometimes on as many as three to four subsequent days. In the academic year of 2011, to improve the faculty's time commitment and balance of teaching and work load, a self-directed video tour was produced and placed on the ED's iPad tablet computers. In this study, we compared the effectiveness of two methods of teaching, the self-directed video tour vs. the PEM faculty tour, on medical trainees' learning about the ED location and safety features. We also investigated medical trainee satisfaction with the type of tour taken.

## **Methods**

This was a single-site quasi-experimental design study assessing knowledge acquisition and satisfaction assessment between two different methods for teaching important information on ED location and safety equipment to medical trainees. We obtained approval for this study from the Institutional Review Board of Children's Mercy Kansas City (CMKC).

# **Setting and Study Group**

This study took place at the Department of Emergency Medicine, CMKC, which is comprehensive pediatric medical center with multiple locations in Missouri and Kansas. Most recent data showed that the emergency room had 67,910 visits in this teaching hospital.

Using the convenience sampling method, we recruited our subjects in the ED rotations. The subjects included medical students from regional Midwest medical schools and residents from local emergency medicine, family medicine, pediatric, and internal medicine/pediatric training programs. All subjects were starting their PEM clerkship and agreed to participate in the study. We excluded participants (a) who had a prior clerkship through the CMKC ED; and (b) were re-rotating as medical residents and had already received an ED tour. A total of 62 participants remained, who were divided equally into two groups. Groups were divided by alternating orientation days until we had 31 participants in each group.

# **Study Instruments**

## Video development

In designing the video, we embedded effective cognitive strategies derived from Mayer's cognitive theory of multimedia learning [2], so that learners could construct knowledge in meaningful ways. The principles of cognitive theory of multimedia learning are drawn from several cognitive theories, such as Baddeley's model of working memory [3], Paivio's dual-coding theory [4], and Sweller's cognitive load theory [5,6]. According to the principles of these cognitive theories, there are three basic assumptions as outlined below:

- The dual-channel assumption: Based on Baddeley's theory of working memory [3] and Paivio's dual-coding theory [4], working memory has auditory and visual channels.
- 2. The limited capacity assumption: Based on Sweller's cognitive load theory [5,6], each

component of working memory has a limited capacity that relates to the amount of information that working memory can hold at one time.

3. The active processing assumption: Learners actively process information through filtering, selecting, organizing, and integrating information based upon prior knowledge.

In the light of these cognitive learning theories, our goal was to increase the instructional effectiveness of the video to be developed. The video was produced combining live video with simple animations created in PowerPoint and recorded with screen recording software. Development tools also included TechSmith Camtasia Studio (for recording the PowerPoint animations) and Sony Vegas Movie Studio (for editing the footage together and adding titles and labels). The video tour required the trainee to carry and watch the iPad and "tour" the ED by following the instructions and directions

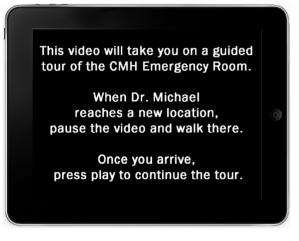


Figure 1. Video ED tour introduction screen shot.



Figure 2. Video ED tour screen shot.

on the video (Figs. 1–5). The video covered all the same content and educational items provided previously by the PEM faculty-guided tour and all video content was reviewed and validated by our section leadership prior to the development. The video used a split screen to help orient the viewer: on one half of the screen, a PEM faculty member gives a guided virtual tour, while on the other half an animated figure moves over a simplified blueprint of the ED.

## Knowledge acquisition survey

The knowledge acquisition survey was developed to measure trainee post-tour recall of ED location and safety features. The knowledge acquisition survey consisted of 12 questions, with the total score calculated for knowledge acquisition reflecting the number of correct responses. The resulting knowledge acquisition survey score ranged from 0 to 12, with 12 being a perfect score.



Figure 3. Video ED tour screen shot.



Figure 4. Video ED tour screen shot.

## **Orientation evaluation (satisfaction)**

This survey was developed to measure trainees' satisfaction with the ED orientation (self-directed video tour *vs.* an attending-led tour). The survey items consisted of 10 statements on a five-point Likert scale, with a higher number associated with a higher satisfaction rating. The satisfaction total score was a sum of the satisfaction items resulting in a range of 10–50. One open-ended question was included to obtain any further comments from trainees on their learning experience.

## **Data Collection Procedure**

Subjects were enrolled from February 1, 2015 through September 30, 2015, and were assigned to either the PEM faculty-led tour or video tour group dependent on the type of tour scheduled for that



Figure 5. Video ED tour screen shot.

day. On the day of a PEM faculty-led tour, the faculty member was blinded to trainee participation in the study. Residents or medical students who declined to participate received the type of tour scheduled for that day but were not enrolled in the study. Both tours covered exactly the same content. A map of the ED with reference points to ED locations and safety equipment as shown on the iPad tour was also provided to trainees to follow along with during the PEM faculty-led tour (Fig. 6). To maintain consistency, the PEM faculty members (JGM, SMW, CMD, and CAT) providing the in-person tour followed a script detailing the same content and in the same order as that shown on the iPad. After each tour, the trainees were asked to complete the knowledge acquisition survey as well as the orientation evaluation survey.

# **Data Analysis**

With a sample size of 31 trainees in each group, we established 80% power to detect an effect size of 0.736 using a two-group *t*-test with a two-sided significance level of 0.05. Medians, interquartile ranges (IQR), and proportions were used to summarize the data. MannWhitney *U* tests were used for group comparisons of the satisfaction total scores. Chi-square and Fisher's exact tests were used to compare groups on categorical variables. Overall knowledge acquisition was analyzed in a success among trials approach using a binary logit model. SPSS version 23 and SAS 9.4 were used for data analysis. A significance level of 0.05 was used for all tests.

We analyzed the qualitative data from the openended question (further comments) thematically [7].

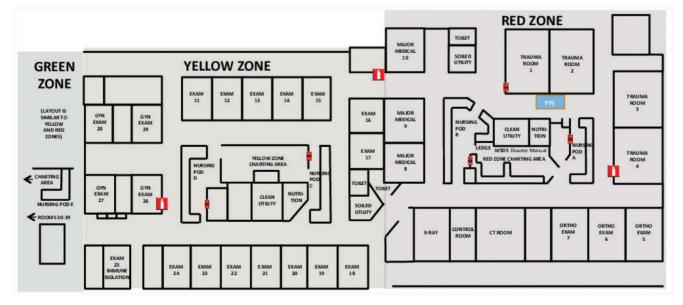


Figure 6. Master ED map with icons.

### Results

A total of 62 subjects were enrolled, including 31 subjects who received the PEM faculty-led tour, and 31 who received the video tour (Table 1). All subjects completed the knowledge acquisition and orientation evaluation (satisfaction) surveys.

## **Knowledge Acquisition**

The results showed that trainees who received the PEM faculty-led tour group answered 91.1% of the knowledge acquisition questions correctly, compared to 87.4% of the video tour group [odds ratio (OR) = 1.49, 95% confidence interval (CI): 0.93, 2.38]. When looking for differences by training level, we found that the odds of medical students having a correct response were 3.77 times higher than those of trainees in postgraduate year (PGY) 1 (95% CI: 1.61, 8.83). Also, the odds of trainees in PGY 2 having a correct response were 1.76 times higher than those of trainees in PGY 1 (95% CI: 1.01, 3.08). When evaluating individual knowledge questions, we found that only one question (number 2) was missed more often by the video tour group than by the PEM faculty-led group (45.2% vs. 16.1%, *p* = 0.013) (Table 2).

## Satisfaction with Orientation

Trainees who received the PEM faculty-led tour scored statistically higher (p = 0.002) in terms of satisfaction, with a median total score of 47 (IQR 42–49) compared to the median total score of 40 (IQR 39–44) for the video tour group. When looking for differences in individual satisfaction questions, we found significant differences in 6 of the

10 questions, with a median of 4 (Agree) for the video tour group and a median of 5 (Strongly Agree) for the PEM faculty-led group for each question (Table 3). We did not find any relationship between the total satisfaction score and the participants' level of training (p = 0.978).

When evaluating for correlation between the knowledge acquisition and satisfaction scores, we found no significant relationship between knowledge acquisition survey performance and satisfaction total scores (p = 0.400).

### **Qualitative Feedback from the Participants**

The majority of comments on the PEM faculty-led tour were related to the convenience of being able to ask the PEM faculty a question and receiving an answer immediately. Participants expressed their appreciation for this on-demand conversation. As for the video-based tour, most comments were very brief, such as "I enjoyed the iPad tour! Great idea," "Great quick tour," "Great video tour," and "More time spent covering the layout and how to orient yourself in the department would be helpful."

### Discussion

The primary objective of our study was to compare the effectiveness and learning outcome with the self-directed video tour *vs.* the PEM faculty-led tour of the ED location and safety features in the ED orientation. The results showed that the PEM faculty-led tour group scored statistically higher on the knowledge acquisition and satisfaction surveys. These results may reflect that some learners do better with self-directed learning tasks, while others do better with traditional in-person instructional

**Table 1.** Level of training and type of trainee for each tour group.

	Attending led tour (n = 31)	iPad tour ( <i>n</i> = 31)	<i>p</i> -value	
Level of training				
Medical student	6 (19.4%)	6 (19.4%)	0.934	
PGY 1	9 (29.0%)	7 (22.6%)		
PGY 2	10 (32.3%)	12 (38.7%)		
PGY 3	6 (19.4%)	6 (19.4%)		
PGY 4	0 (0%)	0 (0%)		
Type of trainee				
Emergency medicine	8 (32.0%)	9 (36.0%)	0.046	
Pediatrics	1 (4.0%)	7 (28.0%)		
Internal medicine/pediatrics	2 (8.0%)	0 (0%)		
Family medicine	14 (56%)	9 (36%)		

#### Table 2. Knowledge survey—individual questions results for each tour group.

	Attending-tour	iPad tour		
Question: correct answer	% correct (n)	% correct (n)	- <i>p</i> -value	
Please select the location of the fire alarm pull in Pod B: location 4	80.6 (25)	71.0 (22)	0.375	
Please select the location of the fire extinguisher in Pod A: location 5	83.9 (26)	54.8 (17)	0.013	
Please select the location of the fire alarm pull in Pod C: location 2	80.6 (25)	74.2 (23)	0.544	
Please select the location of the fire alarm pull in Pod D: location 3	84.0 (26)	81.0 (25)	0.740	
Please select the location of the Disaster Manual and the Safety Data Sheets: location 5	100 (31)	100 (31)	1.00	
Please select the location of "the ledge" : location 2	97.0 (30)	100 (31)	0.313	
Please locate where the large personal protective equipment cart is located: location 3	87.1 (27)	87.1 (27)	1.00	
The combination number to the soiled utility room is: 514	100 (31)	100 (31)	1.00	
The laceration equipment cart color is? Blue	84.0 (26)	90.3 (28)	0.449	
). I can locate the personal protective equipment cart located outside: Trauma Bay areas 1 and 2	97.0 (30)	94.0 (29)	0.554	
. I know to put the used laceration repair equipment into the bins	100 (31)	100 (31)	1.00	
2. "The ledge" is important because: it is the location where the clipboard assigned to the patient next to be seen is placed	100 (31)	97 (30)	0.313	

#### Table 3. Satisfaction survey—individual questions, five-point scale.

	Median (IQR) 1 = strongly disagree 5 = strongly agree						
Satisfaction questions	Attending	iPad ( <i>n</i> = 31)	<i>p</i> -value	Attending	iPad		
	( <i>n</i> = 31)			( <i>n</i> = 31)	( <i>n</i> = 31)	<i>p</i> -value	
I felt welcome in the ED	5 (4.5)	4 (4.5)	0.004	96.8%	83.9%	0.053	
I felt my time was well spent	5 (4.5)	4 (4.5)	0.073	93.6%	87.1%	0.354	
The ED tour covered important information that will be useful for my rotation	5 (4.5)	4 (4.5)	0.227	96.8%	96.8%	1.000	
The ED tour was conducted in an informative and efficient manner	5 (4.5)	4 (4.5)	0.045	96.8%	93.6%	0.492	
The ED tour taught me about safety issues I did not realize that it were important prior to the tour	4 (3.5)	4 (3.4)	0.169	67.8%	54.8%	0.468	
The information related to the location of the Personal Protective Equipment Cart will be useful for my upcoming rotation	5 (4.5)	4 (4.5)	0.004	96.8%	96.8%	1.000	
I am satisfied with the knowledge provided about the location of the Safety & Disaster Manual	5 (4.5)	4 (4.5)	0.302	93.6%	96.8%	0.492	
I am satisfied with the knowledge provided about the location of the fire extinguishers	5 (4.5)	4 (4.5)	0.002	93.6%	77.4%	0.104	
I am satisfied with the knowledge provided about the location of the fire alarm pull boxes	5 (4.5)	4 (4.5)	0.001	96.8%	90.3%	0.612	
I am satisfied with the knowledge provided about the location of "the ledge"	5 (5.5)	4 (4.5)	0.006	96.8%	93.6%	0.492	

methods. Another possible interpretation is that we need to further improve the content design and implementation process of the iPad video tour.

Virtual tours and video instruction have previously been developed for medical educational activities. Kahn et al. [8] used a grocery store tour to teach medical students nutritional information, testing knowledge gained from either an in-person or a virtual tour model (PowerPoint presentation). The authors reported no difference in knowledge gain between the in-person teaching model and single-session virtual teaching model and no difference in satisfaction between methods. Tews et al. [9] reported that medical students' patient presentations were improved after watching instructional videos on iPod Touch devices. The authors concluded that these devices were useful for medical student education, and that they could augment bedside teaching in situations where live or interactive teaching is unavailable. Similar to our study, Mahadevan et al. [10] described developing an emergency medicine clerkship orientation process using internet-based streaming video technology to teach the physical layout and operations of their ED. As with our study, they had also previously used an attending-led orientation model and developed the streaming video orientation process to facilitate better use of staff time. They described the benefits of this process to include "decreased faculty work hours for orientation and resultant cost savings, uniformity of orientation content, and the ability to orient any time and from any computer with internet access." They also postulated that their method had the potential to improve the efficiency of trainees and faculty, to reduce medical and system-based errors, and to improve resident satisfaction. Their study differs from ours in that they did not compare trainee knowledge acquisition or satisfaction between the video orientation process and the attending-led orientation process. They acknowledged a plan for future study that would investigate whether trainees were better prepared for working in the ED after using the new orientation method, if the trainees found the orientation process valuable, if it made them more efficient, and if it helped to reduce errors and improve patient care [10].

Using an iPad to deliver clerkship orientation material, such as our video ED tour, shows promise as a convenient method of instruction. We believe the difference in outcomes between the virtual and in-person teaching methods may not be "educationally significant" enough to warrant eliminating the iPad video tour, but modifications are needed. Therefore, we plan to make the following changes:

1. We will modify the introductory email to inform trainees that they will be participating in a "video iPad ED tour," and we will provide a link instructing them to preview the video through the institutional education portal. This process change may address the comment regarding the video-based tour, "More time spent covering the layout and how to orient yourself in the department would be helpful," which suggested that certain trainees benefit from better pre-tour preparation.

- 2. Although we designed the video using a solid theoretical framework (cognitive theory of multimedia learning principles) to increase the instructional effectiveness, we need to revisit the interactivity elements of the content. At this point, we plan to integrate interactivity into the video that will provide ways for trainees to ask questions, either in written, recorded or text message format that would be answered synchronously or asynchronously by a PEM faculty member. This change attempts to simulate the benefits of the one-on-one interaction trainees perceived during the PEM faculty-led tour. In addition, educators, academics and learning communities advocate 3-Dimensional Virtual Learning Environment (3D-VLEs) for practicing skills or undertaking embodied action emphasizing individualized learning with flexibility, while at the same time facilitating the exploration of learning tasks by being able to move freely around the 3-D VLEs [11]. All these benefits and unique characteristics of 3-D VLEs are worth exploring to make our ED orientation more effective.
- 3. We will build in intermediary stops along the video tour route, asking the participant to answer quiz questions, or perhaps provide optional links to frequently asked questions in context to where the trainee is standing, again, to increase the interactive nature of the iPad video tour.
- 4. We will employ a post-tour survey requesting feedback about the PEM clerkship orientation process for ongoing improvement assessment.

In the appropriate setting, the iPad or similar technological devices can be a useful tool to deliver educational material to medical trainees. Using these types of devices has the potential to improve the balance between teaching and workload for educational faculty. We need to revisit instructional content and design that works best via this format, including self-directed and self-determined learning pedagogies with multimedia-enhanced instruction.

# **Limitations of Study**

Our study has limitations. First, for both groups, we did not employ trainee "teach back" of tour content prior to the knowledge acquisition or satisfaction surveys. This method has been shown to reinforce and improve recall of important educational points [12]. Second, we did not assess the participants' technology skill levels and experience with tablet computers such as the iPad. Third, our knowledge and satisfaction survey measures are specific to our ED tour process and to the content we chose to study. Thus, our method and results may not be generalizable to other programs with similar clerkship orientation processes. Lastly, the iPad video tour group did not have an opportunity to ask questions or receive feedback from a PEM attending during or after their tour, again raising the question whether improving the interactive nature of the virtual method could improve recall and satisfaction.

## Conclusions

Completing an ED tour is an important expectation for all medical trainees as part of their PEM clerkship orientation. Our study directly compared technology-based to traditional in-person based instructional methods to teach medical clerkship orientation material. We believe our approach to the design of the ED orientation tour was novel and helped us to see this educational method from a different perspective. Although our study results statistically favored the attending-led tour, in fact, both methods were well received by trainees and the results are not deemed "educationally significant" enough to eliminate the iPad tour. At this point, we will continue to use the iPad video tour, but with modification to the pre-orientation process and to the video tour content. Medical trainee instruction delivered via mobile technology devices such as the iPad can augment faculty education time. Optimal content and design of educational activities delivered by this method requires further study and learning outcomes that should be compared to traditional teaching methods.

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# **Conflict of Interest**

The authors have no conflict of interest to declare.

### References

- Hayworth J, Whitley TW, Allison JR, EJ, Revick DA. Predictors of work satisfaction among SHOs during accident and emergency medicine training. Arch Emerg Med 1993; 10:279–88.
- [2] Mayer RE. Multimedia learning. 2nd edition. Cambridge University Press, New York, NY, 2009.
- [3] Baddeley AD. Working memory. Oxford University Press, Oxford, UK, 1986.
- [4] Paivio A. Mental representations: a dual coding approach. Oxford University Press, Oxford, UK, 1986.
- [5] Sweller J. Cognitive load during problem solving: effects on learning. Cogn Sci 1988; 12:257–85.
- [6] Sweller J. Cognitive load theory, learning difficulty, and instructional design. Learn Instruc 1994; 4:295–312.
- [7] Patton MQ. Qualitative research and evaluation methods. Sage, Thousand Oaks, CA, 2002.
- [8] Kahn RF, O'Sullivan P, Vannatta PM. Supermarket tour: the effect of presentation mode on nutrition knowledge and attitudes. Fam Med 2003; 35:721–5.
- [9] Tews M, Brennan K, Begaz T, Treat R. Medical student case presentation performance and perception when using mobile learning technology in the emergency department. Med Educ Online 2011; 16:7327.
- [10] Mahadevan SV, Gisondi MA, Sovndal SS, Gilbert GH. Emergency department orientation utilizing webbased streaming video. Acad Emerg Med 2004; 11:848–52.
- [11] Dalgarno B, Lee JW. What are the learning affordances of 3-D virtual environments? Br J Educ Technol 2010; 41(1):10–32.
- [12] Caplin M, Saunders T. Utilizing teach-back to reinforce patient education. A step-by-step approach. Orthop Nurs 2015; 34:365–8.