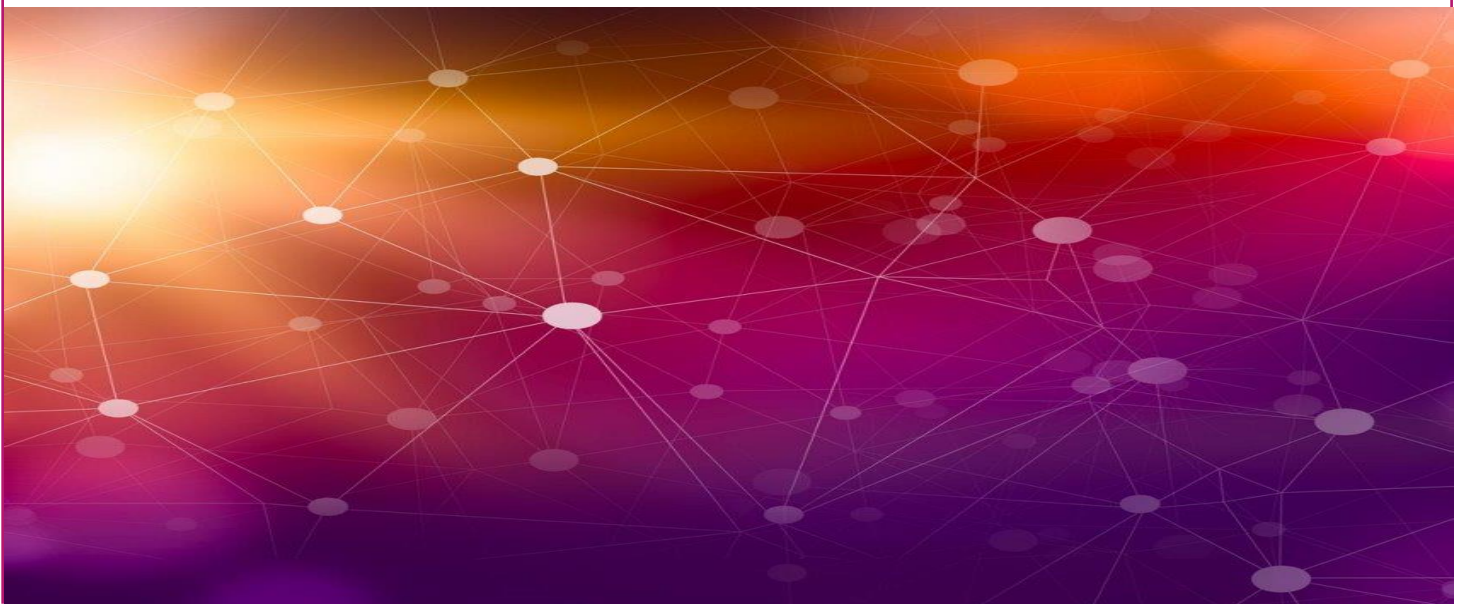# Measuring the Impact of Medical Games on Experienced Physicians' Knowledge and Practice Decisions

LEVEL EX

Outcomes

EXECUTIVE SUMMARY

Level Ex and CE Outcomes collaborated to design and implement a study demonstrating the effectiveness of educational video games in increasing knowledge and improving physician competency. Level Ex creates medical video games for clinicians across specialties; this study specifically focused on the Top Derm game, which is designed for dermatologists using knowledge and reasoning-based mechanics paired with real and ultra-high fidelity, computer-graphic generated images of various skin conditions and diseases.

To demonstrate the effectiveness of the Top Derm game on physician knowledge outside the game, CE Outcomes designed a closed study to recruit a random sample of US practicing dermatologists to complete the study. Study participants were required to complete:

1. Pre-assesment	2. Top Derm game modules	3. Post-assessment (2 weeks following)

A total of 59 US-practicing dermatologists completed the study during a period of February - April 2022. Dermatologists had an average of 14 (range 1-28) years of experience in dermatology after completing their training.

Key study findings include:

- ✓ Not only did learners demonstrate increased competence in diagnostic and management choices within the game, they showed improved decisions and reinforcement of optimal patient care outside the game, weeks later in the follow-up post-assessment.
- ✓ Findings were consistent across learners regardless of length of time in practice, indicating game-based education is equally effective across a wide spectrum of ages.
- ✓ Learners reported high satisfaction with gaming technology and educational content with >70% reporting the format and learning from the Top Derm games was better than "traditional" CME.

Conclusion:

This study demonstrated the Top Derm games enhanced clinical competence, particularly in more rare dermatologic conditions, and reinforced knowledge with more common dermatologic conditions. Notably, the impact of the game was seen across a diverse range of dermatologists indicating there is a wide applicability of this style of learning. Further, among busy, practicing dermatologists, the game was not just enjoyable, but imparted knowledge that was retained and transferred to better clinical decision making outside the game.

INTRODUCTION

Much of continuing medical education is delivered via traditional models, including didactic lectures, on-demand video, or through text or journal articles.[1] Studies have suggested that video games can be effective[2,3]; creating education as a game can be challenging due to the complexities of needed technology while ensuring clinically accurate content and designing the game in an engaging and fun format. Level Ex focuses on developing video games for clinicians that capture the challenges of practicing medicine with the goal of bridging gaps in the healthcare industry through video game technology and psychology.

STUDY GOAL

Level Ex partnered with CE Outcomes, an independent assessment company with over 20 years of experience in conducting studies to evaluate the impact and outcomes of continuing medical education. The goal of the collaboration was to design and implement a study to demonstrate the effectiveness of Level Ex games in increasing knowledge and improving clinical competency. Level Ex has created numerous games targeting specific specialty audiences and over time, has captured data demonstrating clinician in-game improvements and satisfaction with the gaming technology and educational content. This collaborative study was designed to augment the data Level Ex has captured with additional 3rd party independent study data demonstrating the impact of their educational games on practicing physician knowledge and practice decisions.

STUDY DESIGN

In order to achieve the goal of demonstrating the impact of educational games on experienced physician knowledge and practice, CE Outcomes designed a closed study to recruit a random sample of physicians in the target audience to participate in a pre-assessment, complete a set of educational gaming modules, and complete a follow-up assessment conducted at least 2 weeks following exposure to the educational games.

For this study, Level Ex identified the Top Derm game designed for dermatologists. CE Outcomes worked in collaboration with Level Ex clinical advisors in dermatology to develop an assessment instrument based on the content of the educational game modules that was designed to assess the impact of the education on knowledge and practice.

This study utilized a case-based assessment including patient case-vignette scenarios as the pre- and post-assessment. Case vignettes have gained considerable support for their value in predicting healthcare provider practice patterns. Results from research demonstrate that case vignettes (compared to chart review and standardized patients) are a valid and comprehensive method to measure processes of care in actual clinical practice.[4,5,6]

The cased-based assessment was utilized prior to education and again after the education, with the addition of questions to assess satisfaction with the gaming platform and educational content, barriers to implementing learnings, and future educational preferences.

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Learner recruitment

US practicing dermatologists were recruited to participate in this closed study. (N = 59).

Pre-assessment

Case-based assessment fielded to dermatologist participants prior to exposure to education to measure their baseline knowledge and approach to patient management.

Educational activity

Dermatologists were required to participate in 5 identified Top Derm game modules between February and April 2022

Post-assessment

At least 2 weeks following completion of the education, dermatologist were contacted to complete the post case-based assessment.
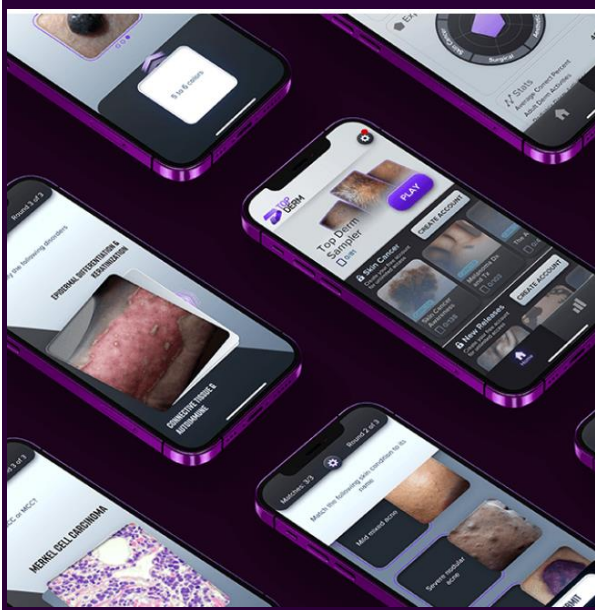
WHAT GAMES WERE USED IN THIS STUDY?

Level Ex creates medical video games for clinicians across specialties. This study specifically focused on the Top Derm game, which leverages many of the same mechanics as other Level Ex games but was designed particularly for dermatologists with input from a large panel of dermatology experts. The Top Derm game modules use game-based knowledge mechanics and include video game graphics technology to create medically accurate, high-resolution imagery of various skin disorders and diseases, giving dermatologists the opportunity to visually experience a wide variety of dermatology scenarios.

Top Derm includes short, rapid-fire, focused challenges, designed to provide a range of dermatology game modules and challenges that strengthen dermatologist knowledge and ability to visually identify common and rare skin disorders, in order to ensure proper diagnosis and patient management.

Learners in this study were asked to participate in 5 game modules:

1) Pesky Pimples, which pertains to acne conditions and related treatment challenges
2) Derm Hero, which addresses atopic dermatitis conditions and challenges
3) Zebra Cases, which refer to skin disorders out of the ordinary
4) Melanoma DX and TX, which addresses melanoma diagnosis types and treatment challenges
5) Visual Skinsations, which addresses hair and scalp disorders.

While the games are publicly available, the identified game modules were created in a closed-access environment for the learners in this study.

LEARNER PROFILE

A total of 59 US-practicing dermatologists completed all components of the study. The dermatologists ranged in age from 32 to 57, with 65% of the sample age 45 years old or younger and with an average of 14 years of practice experience. The dermatologists were all in a community-based dermatology practice setting and were busy practitioners who saw an average of 151 patients per week. The vast majority of their patients (avg. 86%) being seen for medical dermatology issues as opposed to cosmetic dermatology

Dermatologists were asked to participate in the 5 identified educational game modules during a period of February - April 2022.

Learners spent an average of over 2 hours playing the Top Derm game modules for this study

KEY STUDY FINDINGS

✓ Learners demonstrated increased competence in diagnostic and management choices within the game modules

✓ Learners showed practice decision improvements within the game and reinforcement of optimal patient care in the post-assessment outside the game, weeks later

✓ Findings were consistent across learners regardless of length of time in practice, indicating game-based education is appealing and effective across a wide spectrum of ages.

LIKELIHOOD TO RECOMMEND

Following completion of the study, dermatologists were asked to rate their likelihood to recommend a gaming tool such as Top Derm to their colleagues on a scale from 1 (not at all likely) to 10 (extremely likely). On average, likelihood to recommend Top Derm games to a colleague was 7.6, with 78% of dermatologists rating their likelihood between "7" and "10." Further, when asked what colleagues they were likely to recommend, 47% reported that they would recommend the games to all their colleagues.

How likely would you be to recommend an (educational) tool like the Top Derm game to your colleagues?

> 78% of dermatologists are very/extremely likely to recommend Top Derm games to a colleague.

Not at all likely ⟶ Extremely likely
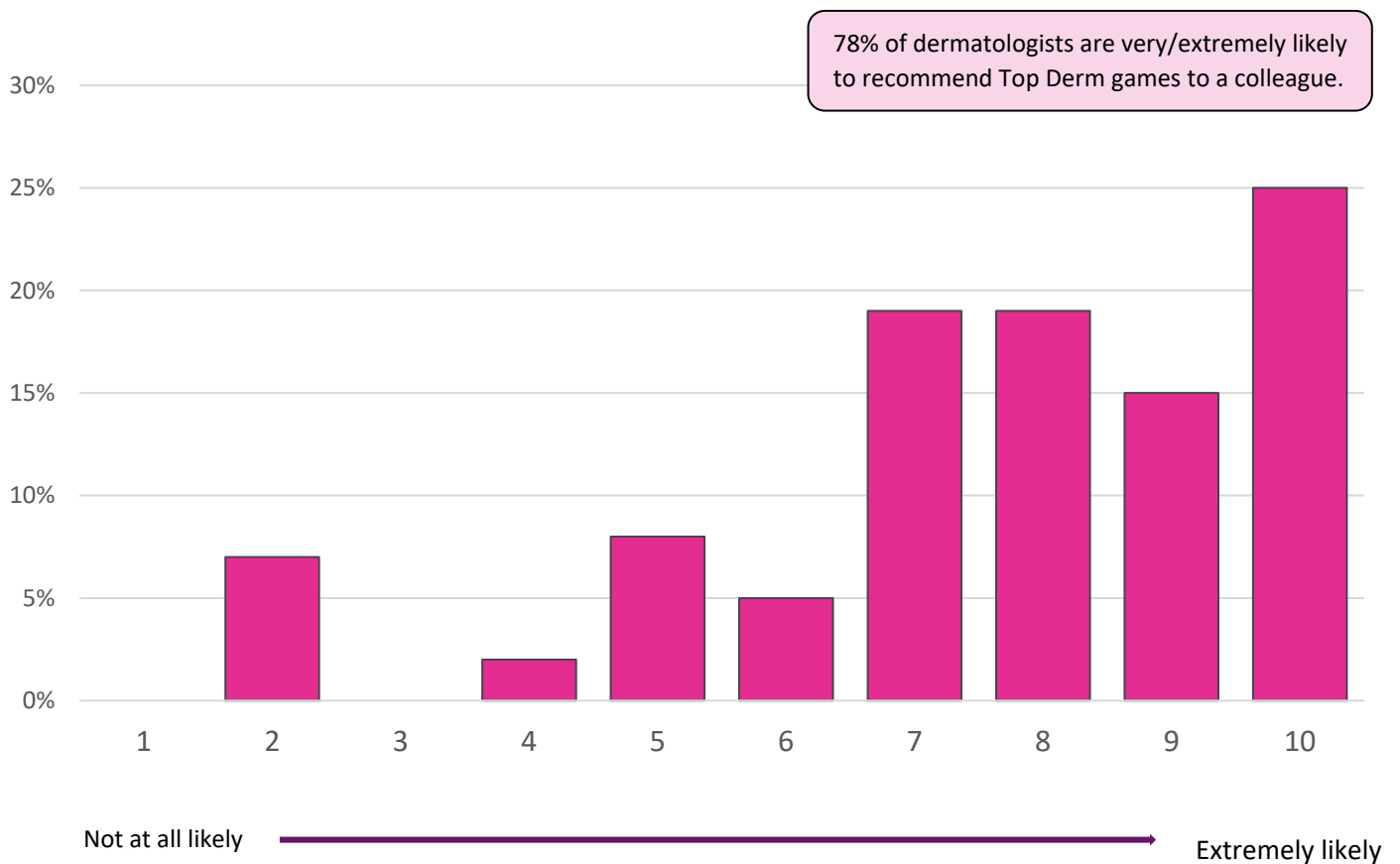
COMPETENCE: IN-GAME IMPROVEMENTS

Across the 5 game modules, learners improved 17% in their scores from their first attempt at the in-game challenges to their additional attempts.

Pesky Pimples:
Learners had an average score of 75% when answering the in-game prompts on the first attempt.

Average improvement from 1st attempt to additional attempts:
24%

Derm Hero:
Dermatologists averaged 76% correct when answering the in-game prompts on the first attempt.

Average improvement from 1st attempt to additional attempts:
22%

Zebra Cases:
Dermatologists averaged 70% correct when answering the in-game prompts on the first attempt.

Average improvement from 1st attempt to additional attempts:
14%

Melanoma Dx and Tx:
Dermatologists averaged 74% correct when answering the in-game prompts on the first attempt.

Average improvement from 1st attempt to additional attempts:
12%

Visual Skinsations
Dermatologists averaged 69% correct when answering the in-game prompts on the first attempt.

Average improvement from 1st attempt to additional attempts:
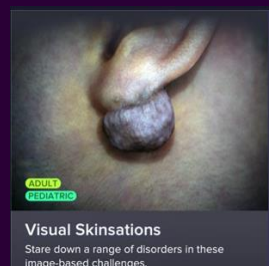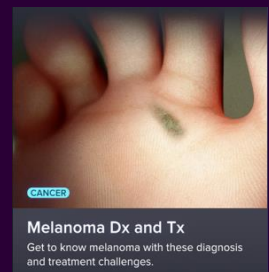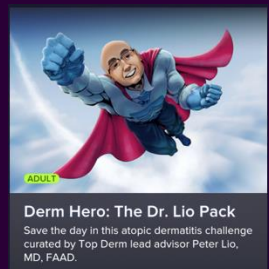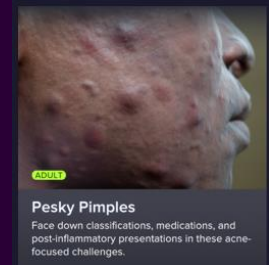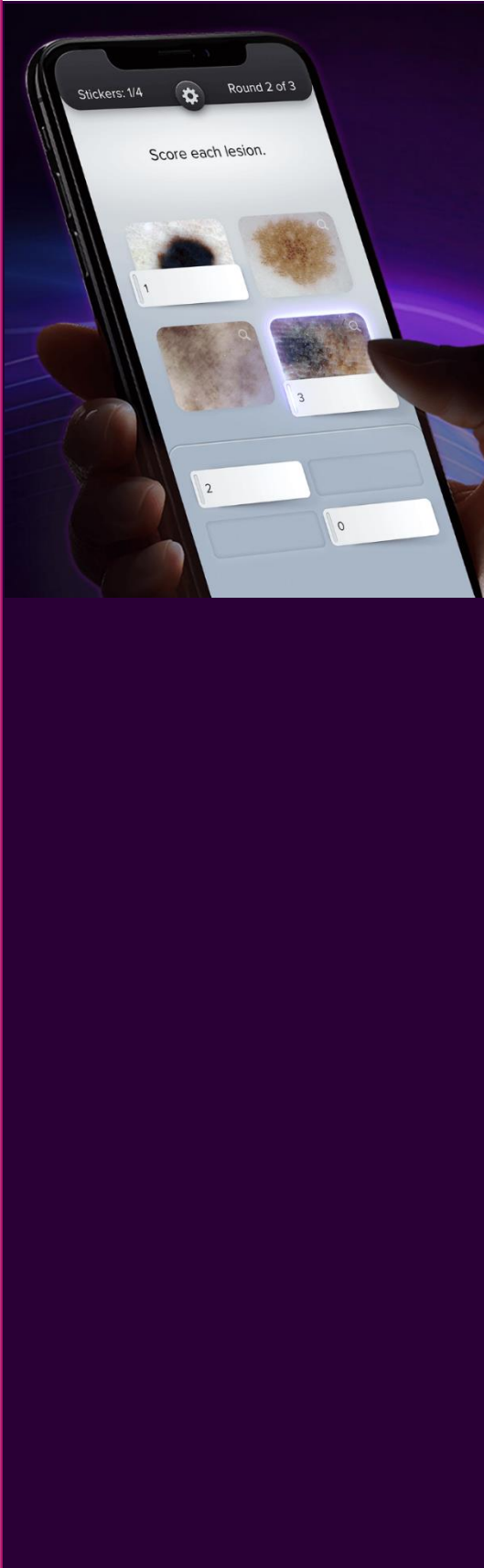14%

Pesky Pimples
Face down classifications, medications, and post-inflammatory presentations in these acne-focused challenges.

Derm Hero: The Dr. Lio Pack
Save the day in this atopic dermatitis challenge curated by Top Derm lead advisor Peter Lio, MD, FAAD.

Zebra Cases
Hunt down atypical diagnoses in these challenges focused on rare conditions.

Melanoma Dx and Tx
Get to know melanoma with these diagnosis and treatment challenges.

Visual Skinsations
Stare down a range of disorders in these image-based challenges.

KNOWLEDGE & PRACTICE IMPACT

The pre- and post-assessment allowed for the identification of:

1 Practice changes have been implemented; aligned with evidence.

2 Education has reinforced current best practices.

3 Additional education is needed.

**Education shifted approach to managing patients with acne:**

1) Prior to education, for a patient presenting mid-pregnancy with acne, 10% would defer treatment of acne until after pregnancy. Following education, more dermatologists would start the patient on erythromycin for her acne, which would be safe to start during pregnancy. (85% pre; 95% post)

2) Further improvements in treating patients with acne were seen, with more dermatologists opting to include topical benzoyl peroxide when treating a patient's acne with topical clindamycin, in order to decrease the risk of clindamycin resistance. (85% pre; 95% post)

3) There was also an increase in the number of learners who recognized that targeting inhibition of matrix metalloproteinase would prevent additional acne scarring following education. (51% pre; 58% post)

Education helped to reinforce best practices in managing patients with atopic dermatitis:

Several questions designed to assess knowledge and management of a patient with atopic dermatitis had overall high pre-test scores, indicating high awareness and experience among the learner population. The educational modules helped to reinforce best practices in the management of patients with atopic dermatitis.

9

Educational impact consistent across learners regardless of practice experience:

A notable finding from this study is that educational impact remained consistent across dermatologist learners regardless of the amount of time they have been in practice. Often, assumptions are made that gaming and technology platforms may be more attractive and impactful to a younger cohort of the population. The results of this study show that not only was the learning consistent regardless of length of time in practice, but also satisfaction and likelihood to recommend Top Derm games were consistent as well.

Pre-post test score improvement by experience
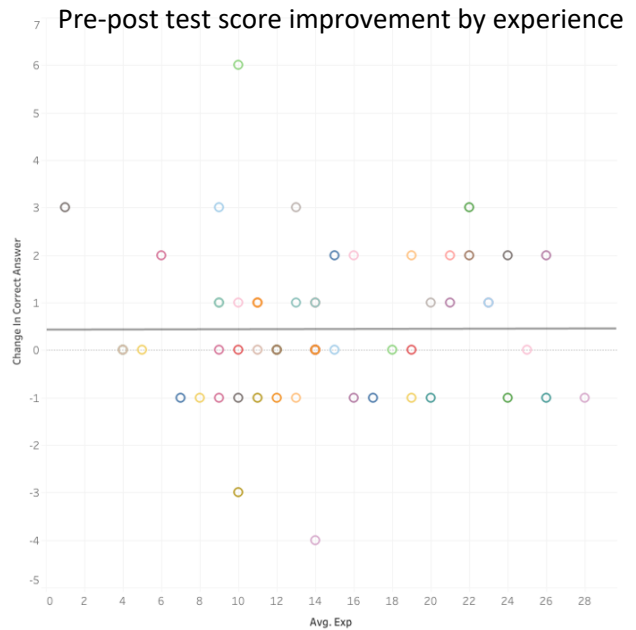
Additional educational needs:

Additional education may be needed in managing patients with rare skin conditions such as mycosis fungoides, as there was notable uncertainty about which treatments are appropriate as initial therapy. Further, just under 50% of respondents appropriately clinically staged a patient presentation of clinical Stage IIA melanoma.

When asked about topics that they would like to see in future education, dermatologists reported a wide range of topics that they would be interested in seeing future gaming activities address, including new treatments as well as a focus on skin cancer, cosmetic dermatology, psoriasis, and alopecia, among others.

Dermatologists requested a wide range of topics for future education.

Please list 1 to 2 dermatology topics that you would be most interested in learning about in future gaming activities such as this. (open-ended)

New treatments/drug pipeline	Skin cancer: melanoma, BCC, SCC
Cosmetic dermatology	Psoriasis (disease, treatment)
Alopecia/hair loss	Dermatopathology

SATISFACTION WITH GAMING TECHNOLOGY & CONTENT

74%
rated <u>learning</u> BETTER than traditional CME

71%
rated the <u>format</u> BETTER than traditional CME

Almost 75% of the learners rated the learning from this gaming format better than traditional CME, and most also rated the format better than traditional CME.

Learners reported that they liked that the Top Derm game modules were enjoyable and interactive, as well as fast-paced and visually appealing.

90% of the dermatologist learners were likely to participate in future Level Ex activities.

What did you like most about this type of education?

Game format
Challenging Unique
Visual/images
Easy to use Fun Interesting
Quiz format Convenient
Interactive
Quick/fast paced
Mobile phone acessible

What did learners say about the educational games?

"I enjoyed this experience and look forward to using gaming apps for CME in the future."

"Love that it feels like you're playing a game."

"It was fun, especially the dermoscopy section. There were a lot of great teaching exercises."

"It is more interactive and attention grabbing. The learning points are more memorable."

"Fast paced and ability to repeat content until fully learned/memorized."

"Stimulation of thought!"

"Fun, clinically relevant, easy to do in spurts"

CONCLUSIONS

This study demonstrated Top Derm games improve the knowledge of experienced physicians and that that knowledge transfers to clinical decision making outside the game, weeks later. As demonstrated through in-game metrics and pre- and post-assessment data, the Top Derm game modules enhanced clinical competence, particularly in more rare dermatologic conditions, and reinforced knowledge with more common dermatologic conditions. Notably, the impact of the game was seen across a diverse range of clinician ages, not just younger clinicians, indicating there is a wide applicability of this style of learning across both those who are more recently out of training, as well as clinicians who have been well established in practice. Further, the vast majority of dermatologists participating in this study preferred the game format over traditional CME activities, perceived the educational learning in the Top Derm game modules to be better than traditional CME, and would recommend these activities to other clinicians.

IMPLICATIONS

The results of this study demonstrate that video games can be an effective educational tool allowing for the simulation of clinical challenges that clinicians face in patient care. Video games should be considered across a range of clinical topics and should not only be considered a learning style for younger clinicians. This study demonstrated that established practicing clinicians who have been in practice longer also perceived this style of learning to be fun and effective. Study participants reinforced this sentiment of wide application as demonstrated through their likelihood to recommend Top Derm games to their colleagues and high likelihood to engage with games again in the future. Video games present an opportunity to make learning more effective in conveying information across disease states. There are a multitude of applications for video games to enhance physician learning and positively impact patient care.

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