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Alpha, Beta, Launch: A Newbie's Guide to Educational Video Game Development

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Abstract

This paper details the process we went through to develop an educational video game, which includes: research on implementing video games into the classroom, vendor selection, video game design, and curriculum development. Throughout the video game development process, we faced challenges such as budget, time constraint, and varying areas of expertise. This paper serves as a guideline for similar organizations interested in educational video game development.

Key Words

Educational Video Games, Curriculum Development, STEM Education, Video Game Design, Video Game Development

I. INTRODUCTION

The American Veterinary Medical Association (AVMA) is a not-for-profit association representing more than 85,000 U.S. veterinarians working in private and corporate practice, government, industry, academia, and uniformed services. The mission of the AVMA is to improve animal and human health, and advance the veterinary medical profession.

The AVMA supports and advances the veterinary medical profession through numerous initiatives, including the education and guidance of young aspiring veterinarians. We introduce veterinary

medicine as a future career choice through the development of resources geared to students from kindergarten through college. Career resources include coloring books, comic books, career posters, and DVDs. All learning resources developed by the AVMA are available for free to students, educators, and the public.

Despite the breadth of resources that are available, there was still a necessity to improve interest in veterinary medicine among middle school and junior high students while supporting STEM education [1]. Children of all races, ethnicities, and genders are less likely to pursue Science, Technology, Engineering, and Mathematics (STEM) fields, including veterinary medicine, without exposure at a young age [2]. The American Veterinary Medical Foundation (AVMF) provided partial funding for development of a new educational resource. The AVMA Communications Department combined this

funding from the AVMF with additional budget and personnel resources to produce a new tool for this unique market.

We researched various best practices on how to reach the middle school audience. According to the National Science Teachers Association (NSTA), research shows middle school years are a time of tremendous physical, emotional, and cognitive changes for students. This is also a pivotal time in their understanding of and enthusiasm for science [3]. Therefore, it was crucial for us to develop a learning resource that is both fun and engaging to the middle school audience, while also providing a tool for teachers to incorporate into their curriculum. Video games as a learning tool are increasingly being recognized as a viable means of assisting in STEM education through skills such as analytical thinking, multitasking, strategizing, and problem solving [4].

Despite our complete lack of knowledge on video game development, AVMA embarked on a year-long journey to develop a game with the middle school audience in mind that would parallel the national science education standards. In addition, we decided to create a teacher's guide on how to incorporate the video game in the classroom, which we learned would increase teachers' usage [4]. The guide that accompanies the video game provides teachers with ideas on incorporating the video game into their curriculum. The guide also includes resources, learning goals, and student activities that align with Next Generation Science Standards. The Next Generation Science Standards put students in the role of scientists – teaching them to observe, to ask questions and make rational decisions about the world around them [5].

II. CHOOSING A VENDOR

AVMA's project team for this initiative consisted

of five individuals from the Communications Division, including one veterinarian. None of us had experience in video game design/development, and a few of us had never played a video game. Our first step in the video game development was to figure out how marketing and communication professionals from a veterinary association were going to pull this off. Obviously, we would need to collaborate with experts who were willing to work with our lack of knowledge and minimal budget. Online searches and industry referrals steered us to Game Gurus, a full-service development studio that specializes in educational and non-violent game development.

During our initial discussions with the staff at Game Gurus, we were impressed with their knowledge and enthusiasm for the educational video game market. Game Gurus has previously partnered with organizations such as Kaplan International Colleges and TERC, a not-for-profit education research and development organization dedicated to improving mathematics, science, and technology teaching and learning.

Game Gurus provided us with examples of different types of games that would suit our timeframe, budget, and target audience. Animal science and veterinary medicine include a diverse array of disciplines and professions that are directly related to health science; animals and animal models are critical to the advancement of human health science, yet students often do not perceive animal scientists and doctors of veterinary medicine as working in a science career [2]. There are six areas of veterinary medicine and the most well-known is the area of private practice. AVMA wanted the game to portray all branches of veterinary medicine. However, time and budget constraints required that we focus on the well-known area of veterinary medicine: small animal (or companion animal) medicine in private practice. Based on our review of various games, we determined

that this area of veterinary medicine would be best illustrated through a time management game.

Game Gurus presented us with a proposal to develop a time-based video game that would appeal to the middle school audience. The proposal detailed their project management approach, and how we could expand the game in the future to include the other areas of veterinary medicine. They also presented details of the graphic style, development platform, project timelines, and payment schedule. Since Game Gurus is located outside of the United States, our leadership and in-house council carefully evaluated the contract and advised us on the pros and cons of doing business with a foreign-based company. After discussions with their references and previous clients, we were confident that we could best work with Game Gurus and signed a contract to move forward.

III. GAME DEVELOPMENT – *AVMA ANIMAL HOSPITAL*

Game Gurus walked us through the game design and development process, which included six phases: design, pre-production, prototype, development phase to alpha, development phase to beta, development phase to gold master, and launch. Weekly conference calls ensued, during which Game Gurus led us through the entire process. It was a learning experience for both AVMA and Game Gurus. We had to learn video game lingo, and they had to familiarize themselves with veterinary medical jargon.

We collectively agreed on the high level overview of the video game and agreed on the game title, *AVMA Animal Hospital*. Players begin the game as a new veterinarian in an animal hospital where they diagnose and treat animals. They also learn about each of the ailments, treatments, and how to manage

their time effectively in order to treat more animals. Game Gurus also recommended that the game be developed using Adobe Flex and Air, which is how many of today's top games are built. The benefit of using this development platform is the ability to create tablet and web versions with minimal additional effort from the same code base, saving time and additional cost.

During the design phase, AVMA communicated specific elements important to our mission, including the variety of animals seen in a veterinary clinic and the gender and racial diversity of the game characters. Game Gurus initiated the game design document, which detailed every initial idea, concept, character, icon, and behavior throughout the game. This document was paramount to the overall success of the game development. The first item to be designed was the home screen.

Figure 1: Initial home screen concept drawing

The next step was to decide which animals to present for treatment. We decided to stick to simple companion animals due to our middle school audience and chose five different animals including a dog, cat, bird, turtle, and guinea pig. While Game Gurus got to work on designing the graphics for the

animals, AVMA got to work on what symptoms and diseases these animals would present. We requested the help of species-specific, expert veterinarians to provide us with the top 10 most common diseases and ailments for our selected animals. Additionally, we gathered information on how veterinarians test, diagnose, and treat each disease/ailment. Once we received this information from our veterinarian experts, we narrowed down the diseases by determining the difficulty level and skills required for the target audience.

During the pre-production phase, Game Gurus came up with graphics for each game character, animal, pet carrier, diagnosis, and treatment icons. This information was compiled and included in the video game design document (figure 2).

Veterinarians who work on AVMA's staff provided feedback based on their professional expertise and experience with animal hospital interiors, animal characteristics, and diagnostic tool imagery. Once the prototype was developed, Game Gurus provided weekly live demonstrations of the game

development progress. Our core team at AVMA would ask questions or voice concerns with the look, feel, and content of the game. Game Gurus showed patience with our seemingly endless questions such as: why is the character on screen moving so slowly or so quickly? Can we change the clothes on the receptionist? Or what is that shadow in the corner of the virtual clinic?

During each live demonstration, our team identified various features needing modification. These changes usually had to do with the placement of the text, size of the font, movement of the pet owners, gait of the veterinarian, music, sound effects, timing for each level, and score display. Game Gurus understood when our questions were due to inexperience in video games and provided guidance. At times our inexperience provided a new perspective, which improved the overall gameplay.

After Game Gurus made required changes and fixed bugs, it was time for beta testing with our target audience. The overall response to the game was positive, but the consensus was that there was

Ailment	Diff.	Symptoms	Diagnostic Tools	Treatments
Misaligned teeth (malocclusion)	1	<p>Symptoms: (S)he isn't eating well and seems to be drooling a lot. (S)he seems to have trouble eating and has bad breath. I think (s)he has also lost weight.</p> <p>Diagnostic findings: When you look in the guinea pig's mouth, you see that his/her teeth don't meet properly, and they're overgrown.</p> <p>Treatment results: You file his/her teeth so they meet better, and recommend timothy hay to help him/her keep the teeth ground better. You recommend rechecking the teeth and filing them as needed at least twice a year.</p>	<p>1. Mouth Exam</p>	<p>1. Cut + File Teeth</p>

Figure 2: Example from video game design document

too much text within the gameplay. AVMA staff reduced the game dialog and copy without losing the educational content. Additionally, we decided that, for educational purposes, we should include a brief back story about our game characters. We wrote a brief synopsis for each character detailing why they decided to become a veterinarian, their education and graduation from veterinary school, and first job as a new veterinarian at *AVMA Animal Hospital*.

Figure 3: Story line screen

After countless meetings, numerous revisions, hours of testing, and eight months of development, we had a finished product. Game Gurus provided us with the video game file to include on AVMA's online educational resources section. They also provided developer files and graphic icons necessary for the online distribution channels such as Google and Apple. AVMA learned how to create a developer account in Google Play and the Apple Store. In the end, our relationship with Game Gurus resulted in an online version of *AVMA Animal Hospital*, which can be played on our website and a downloadable tablet version of the game for use on Android and iOS tablets.

Figure 4: Icon for tablet versions

IV. TEACHER'S GUIDE

The AVMA exhibits at the National Science Teachers Association's (NSTA) national conference each year in April. Although the video game was still in beta testing, we decided a demo of the game would gain interest and feedback from science teachers. The video game was very well received, but feedback suggested that we should definitely create a guide for teachers on how to incorporate the game into the classroom.

Game Gurus recommended a curriculum developer, who also designs video games. We collaborated with her to create an educational game document. This document introduces the game and provides the relevant grade level information to teachers, including educational standards information, key veterinary medicine ideas, and a list of resources (e.g., links to other parts of our web site, online brochures, kid-appropriate articles, etc.). The final teacher's guide contains additional learning activities that leverage the video game and enhance critical thinking through question prompts and suggested topics for research and writing activities.

V. AVMA ANIMAL HOSPITAL DEMONSTRATION

Access *AVMA Animal Hospital* video game for free online or download the free tablet versions and corresponding Teacher's Guide at avma.org/videogame. We also produced a short YouTube

video demonstration, which we use for marketing purposes: <http://youtu.be/E11QvHF8vLI>.

A. Initial Screens

Players are introduced to video game home screen.

Figure 5: AVMA Animal Hospital home screen

To start, players click “Play” and the doors to the animal hospital open. They then choose whether they want to be the male or female veterinarian. Once they choose the male or female character, they see the quick background story for that character before beginning the game tutorial.

Figure 6: Choose a character

Upon playing the game for the first time, the player is presented with a tutorial, which shows a series of arrows prompting them where to click and how to move throughout the game screen. Players also have an option to click on the “Skip Tutorial” button in the bottom right screen.

Figure 7: Tutorial screen

B. Level One Game Play

Once the player completes the tutorial, they then enter level one of the game. As clients arrive at the hospital with their pets inside the carriers, they approach the receptionist. The player clicks on the pet carrier prompting the receptionist to move the animal to the examination table. The veterinarian approaches the examination table and removes the animal from the carrier. In level one, the player has two minutes to treat three animals.

Figure 8: Level one game screen with diagnostic icons

Symptoms are then presented, along with icons for diagnostic tools. Based on these symptoms, the player must choose which diagnostic tool to use and click on the icon. Whenever a new ailment is introduced, a chief veterinarian pops up in the upper left-hand corner to give the player tips on how to diagnose and treat the animal. One challenge we had when creating an educational video game, was finding a balance between displaying educational content, but without making the player read too much text. The veterinarian character in the upper-left and the clickable medical chart were created as another way to provide more information if the player needs it, without disrupting the flow of the gameplay.

Figure 9: Medical chart

If the incorrect diagnostic tool or treatment option is chosen, the player loses five seconds on the clock, but they have another chance to choose correctly. When they click on the correct diagnostic tool, they are then presented with the treatment icons.

Figure 10: Level one game screen treatment icons

Once they choose the correct treatment, the player puts the animal back in the carrier and walks the carrier to the receptionist. The receptionist then gives the animal back to its owner and also gives the owner follow-up instructions to complete treatment. Once three animals are treated correctly, the player receives the congratulations and level up screen. Due to budget constraints we were only able to focus on 23 different ailments. This screen also displays which ailments they have successfully treated. Players are required to treat a specific number of animals, in a certain amount of time to earn points and move up the levels. As they move up the levels, players will also reach different career milestones: new veterinarian, assistant veterinarian, associate veterinarian, senior veterinarian, and chief veterinarian.

Figure 11: Congratulations and level up screen

C. Other Screens

Another feature we included within the game screens is the clickable educational materials. We wanted to offer players with additional educational content on veterinary careers and responsible pet ownership, but could not find a way to incorporate into the gameplay. We approached Game Gurus with the idea to make the brochures on the receptionist's desk and the poster on the clinic wall clickable. The brochures and poster are electronic versions of materials that we actually provide to both educators and veterinarians for use in their clinics.

Figure 12: Client brochures

Figure 13: Pet ownership poster

For more information on the AVMA Animal Hospital, contact the Colleen Krahulik CKrahulik@avma.org or Lori Goszczynski LGoszczynski@avma.org, AVMA Communications Division.

VI. FINAL OUTCOME

Our first venture into educational video gaming was not without its challenges, but overall it was a positive experience. This process helped us identify our target audience more clearly and understand the game development process. We are hopeful that, despite the continual changes in technology and video gaming, combined with our successful initial experience in game development and execution, we will be better prepared for the expansion of *AVMA Animal Hospital*. The next step in our journey is to market this new educational resource to schools, educators, home schools, and the public.

What we learned from the development of *AVMA Animal Hospital*:

- Budget and time constraints are important, but so is flexibility.
- Solicit feedback throughout the process from

your target audience, since they are the ones who will be using it.

- Speak up early if you do not understand the process or if you have questions about the look, sound, or movement. These all impact the ongoing development of the final product.
- The live demo conference calls with the developer are critical, but it is equally important to test the game on your own because sometimes glitches happen at different points in game development.
- Test out your game after any changes are implemented, no matter how simple the changes, because glitches can appear that were not there the last time the prototype was reviewed.
- Video game developers have their own industry lingo. If you do not understand something, do not hesitate to ask as many questions as necessary.
- Decide which platforms you want to use early in the process. The graphics, type of play, text, and size of the finished product vary based on the platform. For example, our game works best on a tablet or website, but the game is difficult to play on a smartphone. Our budget did not allow development for multiple platforms, so we had to choose based on the end goal and audience.
 - Is it online only?
 - Will it be played from an app on a smartphone or tablet?
 - How will you distribute the game? Amazon, Apple Store, Google Play?
 - What size icons will you need? How do you want the icons to look?
- Decide if you are going to charge for the game. If so, how much?
- Be patient with the process, you have many decisions to make, such as sound effects, music, colors, shapes, transitions between screens, and scoring display.
- Game developers can help guide you through the process, and a good developer will build a

relationship with you to gain knowledge of your company/not-for-profit and an understanding of your likes and needs. They also provide valuable input and suggestions based on their experience.

- Decide if the game needs instructions, but keep the text minimal.
- Will you want to add levels or story lines in the future? Think about that in the beginning so that the developer can create the necessary coding for future additions.

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