Animating Primary Hemostasis for Medical Student Education

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Abstract

Physicians have difficulty recognizing and diagnosing disorders of primary hemostasis. The root of this may lie in their education, where students are often taught hemostasis using static graphics. We aimed to create a didactic animation on primary hemostasis for medical students to be used in North American medical schools. To promote widespread use of the animation, we surveyed hemostasis educators from Canada and the US on the animation's learning objectives. The animation's script and storyboard were developed using the Animation Processing Model (APM), a psychological processing model that addresses the perceptual limitations of learners. This animation is the first biomedical animation to use the APM in its design. Furthermore, this is the first didactic hemostasis animation which sought peer consensus for its learning objectives.

Introduction

Physicians have difficulty recognizing and diagnosing primary hemostatic disorders like von Willebrand disease.[1]

In medical school, hemostasis is often taught using static graphics which may fail to capture the temporal and structural complexity of the subject, leading to incorrect mental models.[2]

As compared to static graphics, animation has been shown to improve learning outcomes.[3]

Learning outcomes are statistically higher with medical education digital tools which are developed using a specific learning theory. Furthermore, it is recommended that development of these tools follows establishment of learning objectives for the tool.[4]

The purpose of this project is to develop an animation for medical students which presents an introduction to primary hemostasis.

To inform the animation's content, we aimed to survey educators with experience in teaching hemostasis in North American medical schools regarding learning objectives for the animation.

We elected to use the **Animation Processing Model (APM**) as the learning theory which would guide the animation's pre-production and production.

The APM is a psychological processing model that addresses the perceptual limitations of learners viewing educational animations for which the learner has little or no experience with the animation's content.[5]

References

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Results

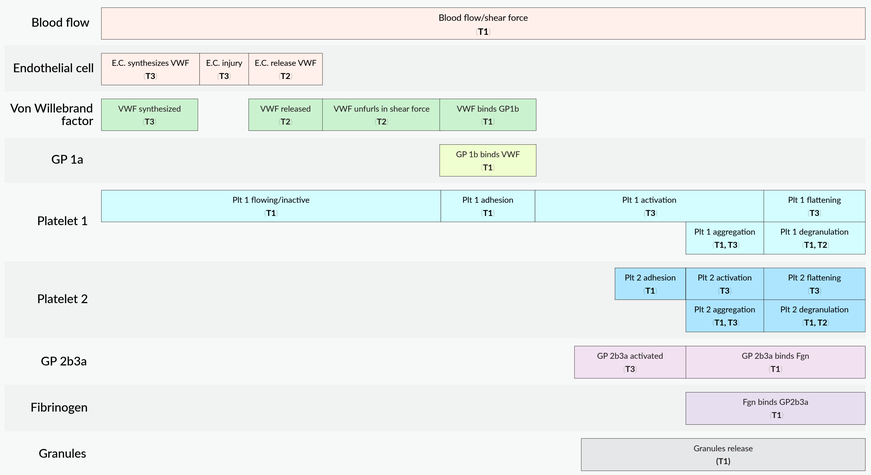

Figure 1: Event Unit Analysis of primary hemostasis learning objectives. Entity actions are indicated as follows: T1=movement, T2=appearance, T3=shape change. GP1a: glycoprotein 1a, GP 2b3a: glycoprotein 2b3a.

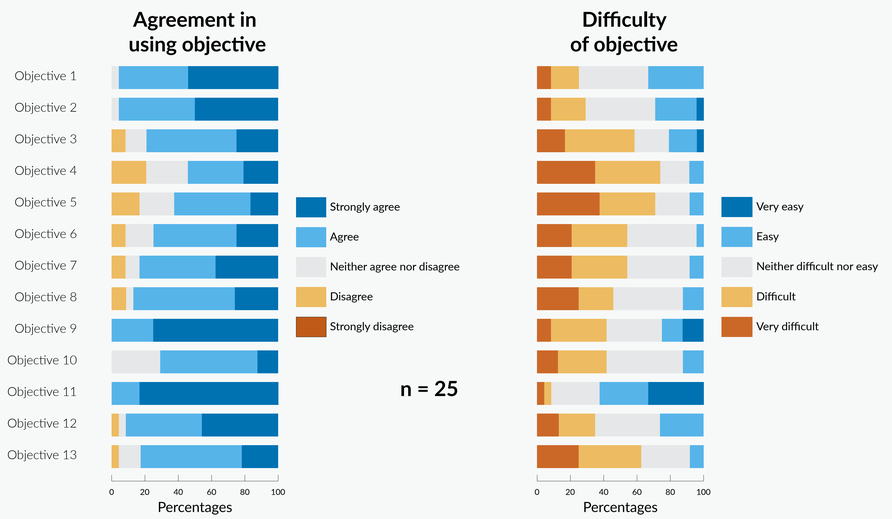

Figure 2: Summary of hemostasis educators survey on animation learning objectives.

Acknowledgements

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Materials & Methods

Learning objectives were abstracted from Robbins and Cotran Pathologic Basis of Disease.[6]

A Likert scale survey was sent via SurveyMonkey (www.surveymonkey.com) to the Association of Hemophilia Clinic Directors of Canada (AHCDC; www.ahcdc.ca) and the Foundation for Women and Girls with Blood Disorders (FWGBD; www.fwgbd.org).

For each proposed learning objective, the survey participant was asked:

1. The degree which the educator supported using each learning objective for the animation.
2. The difficulty faced by a typical medical student in learning the concept posed by the objective.

Objectives underwent an **event unit analysis** according to the APM, pairing the entities of primary hemostasis with each of their discrete actions (movement, appearance, or state change). Following this analysis, a script and storyboard was developed.

The final animation was created using two techniques:

1. Frame-by-frame animation (Rough Animator and Adobe Photoshop)
2. 2D plus animation (Maxon Cinema 4D[Sketch and Toon module], Adobe After Effects, Adobe Audition, Adobe Premiere Pro)

Figure 3: Frame-by-frame animation

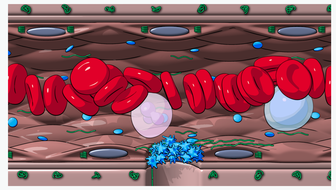

Figure 4: 2D plus animation

See the proposed learning objectives, animatic, and final animation at www.evelynlockhart.com/thesis

Conclusions

First biomedical animation to use the Animation Processing Model to inform its design.

First educational animation on primary hemostasis that sought consensus for its learning objectives.

Manuscript of results to be submitted for publication.

Future plans include:

1. Producing a control animation using a script and storyboard developed prior to the event unit analysis.
2. Performing a randomized study with medical students on learning outcomes between control and APM animations.