

Self-Efficacy and Knowledge After Interactive Computer

Modules in Cardiovascular Physiology

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Background

Cardiovascular physiology is hard! Why?

- Requirement of causal reasoning.
- Students believe memorizing and learning are equivalent.
- Students' difficulty and practice in integrating material.

We believe an important contributing factor is the disconnect between the dynamic events that occur during the typical cardiac cycle and the static images or unrealistic videos used to depict these processes.

Consequence

- Students fail to create the rich mental models needed to master the information and resort to memorization of facts for examinations.
- These difficulties cause students to abandon their original goal of pursuing a career in the health sciences because of decreased self-efficacy (confidence) in physiology.

Our primary aim in this study was to determine if the use of visually-realistic, interactive computer-based models would improve students' self-efficacy and attitudes regarding the material and help promote learning and retention of knowledge.



Results

As hypothesized, the students in the treatment group had more confidence on cardiovascular topics than the students in the control group. The modules demonstrated greater learning of cardiovascular physiology overall, with further analysis needed to identify if specific quartiles of students were impacted more than others. Although the significant increases in content knowledge was only observed in 3 of the 18 questions, the modules appeared to have solidified their confidence in the knowledge they gained. This increase in self-efficacy may be exhibiting the Dunning-Kruger effect, where confidence exceeds cognitive ability.

Zoom in and Scan the QR codes to take a peek!

Comparison of Control and Treatment Group's Confidence Before and After Completing the Module

Item#	Control Group			Treatment Group		
	F Ratio	p value	η ²	F Ratio	p value	η ²
1. ...explain the difference between systole and diastole...	2.02	0.16		5.70	0.02	0.02
2. ...explain why the aortic valve is closed during ventricular diastole...	4.95	0.03	0.02	1.48	0.22	
3. ...explain why the mitral and aortic valves are closed during isovolumetric relaxation...	26.37	<.0001	0.09	2.93	0.09	
6. ...describe the relative durations of atrial diastole and atrial systole...	1.57	0.21		5.58	0.02	0.02
7. ...explain why the aortic and pulmonic valves are closed during ventricular diastole...	10.79	0.01	0.04	6.64	0.01	0.02
8. ...explain why the pressures generated by the left and right ventricles are so different...	6.01	0.01	0.02	9.78	0.00	0.03
10. ...explain why the aortic and pulmonic valves open and close...	7.74	0.01	0.03	12.07	0.00	0.03
11. ...explain the differences between the period of rapid inflow and atrial systole...	4.75	0.03	0.02	2.89	0.09	
13. ...explain what is meant by a blood pressure of '120 over 80'...	8.27	<.01	0.03	12.21	0.00	0.03
15. ...explain why atrial pressure increases three times during the cardiac cycle...	20.02	<.0001	0.07	8.33	0.00	0.03

Note. P Value < 0.05.

Pre and Post Test Comparison on Content Knowledge Before and After Completing the Module

Item	Question	Control			Treatment		
		F Ratio	p value	η ²	F Ratio	p value	η ²
#2	When does pressure in the aorta reach its lowest value?	3.5892	0.0592		4.5103	0.0344	0.0124
#3	Which of the following normally has the longest duration?	0.4531	0.5014		0.7027	0.4024	*
#6	What is the peak pressure generated by normal right atrial contraction?	28.1294	<.0001	0.0904	21.784	<.0001	0.0572
#10	Degenerative changes to the aortic valves can occur in elderly people. As these changes progress, they can lead to retrograde (backward) movement of blood across the valves.... When would this occur?	11.9503	0.0006	0.0405	25.4952	<.0001	0.0663
#11	A runner wearing a heart rate monitor notices that her heart rate has increased from 60 beats per minute at rest to 140 beats per minute during a training session. Why would this be a beneficial response in an exercising body?	2.8972	0.0898		20.0245	<.0001	0.0528
#12	When heart rate increases, the duration of diastole shortens but systole remains the same. Which of the following would be affected by this change?	9.0155	0.0029	0.0309	4.8747	0.0279	0.0134
#13	By listening ...with a ...stethoscope, physicians are able to hear sounds that signal the occurrence of certain events in the cardiac cycle.... If you were listening to a normal patient, what portion of the cardiac cycle would you assume was occurring immediately after you heard the "LUB" sound?	0.0963	0.7565		5.1662	0.0236	0.0142 *
#15	Certain diseases, called cardiomyopathies, can impair cardiac muscle strength. If the left ventricle developed cardiomyopathy, which of the following changes would you expect to observe?	13.9	0.0002	0.0468	8.802	0.0032	0.0239
#16	A child is born with ...an abnormal vascular connection between the aorta and the main pulmonary artery. Which of the following is true about blood flow associated with this vessel?	8.5262	0.0038	0.0292	17.4514	<.0001	0.0464 *
#17	A patient ...suffered a major motor vehicle accident, resulting in the loss of a large amount of blood due to hemorrhage. Assessment ...reveals a low systemic arterial blood pressure (80 mmHg/ 40 mmHg). Which of the following is the MOST LIKELY reason for this patient's low blood pressure (hypotension)?	3.4828	0.063		21.2027	<.0001	0.0558

Note. Bold indicates a statistically significant difference between the group's pre- and post survey responses. The * indicates items where the treatment group scored significantly higher from the control group.

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