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Impact of a Novel Application in Electrocardiogram Interpretation Confidence and Performance in Nurse Practitioner Students

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Abstract

For the last hundred years and to this day, one of the most important diagnostic tools in medicine has been the electrocardiogram (EKG or ECG). The decision to pursue a life-saving intervention, or not, may be heavily based on the interpretation of the results of a diagnostic test. With the weight of impacts to outcomes, one would think there would be ample, if not excessive, time and effort given to teaching practitioners how to interpret an ECG. Unfortunately, with each graduating class of physicians, nurse practitioners, and physician assistants, all of whom have within their scope of practice to interpret ECGs and act upon them appropriately, there are more under-prepared professionals in the field (Burns et al., 2020). Due to the discrepancy between importance of ECG interpretation and subsequent preparation, a novel learning application was created in an effort to improve one's ability and confidence to interpret ECGs. In a quasiexperiement design, a cohort of Seattle University fourth-year DNP student were asked to participate in a six-week program utilizing this novel learning application. Each participant's ability to interpret ECGs, as well as confidence in their preparation and ability, was assessed before and after the intervention. The results demonstrated utilizing the novel learning application increased overall confidence and ability to interpret ECGs. Additionally, it was found that individuals improved their scores significantly post intervention.

Keywords: Electrocardiogram; ECG; EKG; learning application; education; ability; confidence, EKG application; nurse practitioner students; EKG interpretation

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Statement of the Problem

The electrocardiogram (ECG or EKG) remains the most important diagnostic test for evaluation of patient's cardiovascular status. While new technologies continue to evolve, the ECG plays the most central role interpreting cardiac rhythm, conduction system abnormalities and detecting myocardial ischemia. The value of the ECG continues as it is utilized for other types of cardiac abnormalities: valvular heart disease, cardiomyopathy, pericarditis, hypertensive disease, metabolic disturbances, as well as the monitoring of drug treatments (Prutkin et al., 2019). Evaluating an ECG properly goes beyond an acute timeframe, as it is important to be able to compare past ECGs to present in an effort to evaluate evolving disease course as well (Pelter et al, 2019).

The ability to interpret an ECG is not only necessary, but also essential for all advanced practice registered nurses regardless of specialty as well as other providers, such as medical doctors, doctors of osteopathic medicine, and physician assistants (Pontes et al., 2018). This ability to interpret refers to historical ECGs that are part of one's medical record as well as in the acute setting. An unfortunate discrepancy exists between how much training is provided within a given course curriculum versus the important of accurate ECG assessment in the field (Burns et al., 2020). The importance of the ability to interpret an ECG in various healthcare settings by a qualified provider can be the difference between life or death (Hernandez et al., 2019). Practitioners cannot rely solely on the machine interpretation. Rather, they must be able to complete the reading independently (Litell et al., 2019). At this time, there is not adequate ECG interpretation education provided to those expected to sit in the seat of a decision-maker.

Aim of Project

The purpose of this project is to look at the impact of a novel ECG learning application on the confidence, perceived preparation as well as performance of nurse practitioner students. The application has been designed with the idea that more education is needed when it comes to interpreting ECGs for all individuals that have this within their scope of practice. The specific aim of this project is to see if the ability to interpret ECGs as well as the individuals confidence and perceived preparedness are affected after the continued use of the learning tool over a six-week period.

Literature Review

A collaborative, interdisciplinary group of researchers (Faramand et al., 2019) found that prehospital triage (which includes the interpretation of the patient's ECG), when appropriately managed, can significantly impact the outcome of an acute myocardial infarction (MI). In this cohort study of more than 2,000 patients, a review of medical records revealed that individuals triaged as 'high risk' were often older males with histories of coronary risk factors such as: hypertension, diabetes mellitus, coronary artery disease, previous myocardial infarction or previous percutaneous coronary intervention/coronary artery bypass graft. Thirty percent of MI events were misclassified as 'low risk.' There were two independent predictors of misclassification under triage: no previous coronary revascularization and ECG misinterpretation. The conclusion of this study recommended the reinterpretation of ECGs for subtle ischemic changes. Providers must triage appropriately based on personal ECG interpretation. The importance of accurate interpretation could be the difference in life or death for a patient.

A 2020 article by De Bie et al. discussed how accurate ECG interpretation programs were at "detecting abnormal rhythms and flagging for priority review records with alterations secondary to acute coronary syndrome" (p.143). Over 2,000 digital ECGs from electronic health records were converted to analog samples that were then "replayed" on seven different electrocardiographs. Specifically, they assessed ability to discriminate between sinus rhythm versus non-sinus rhythm, atrial fibrillation/flutter, other rhythm abnormalities, and the reliability of the ECG program to flag results for priority review. If all programs did not come to the same conclusion, the sample case was then reviewed by an experienced cardiologist. While all programs did differentiate between sinus and non-sinus rhythm and identify atrial fibrillation/flutter and some other abnormal rhythms, there were both false positive and negative findings. This implies an imperfect system, as the results indicated

> …false-positive rates varied from 2.1% to 5.5% for non-sinus rhythm, from 0.7% to 4.4% for atrial fibrillation/flutter, and from 1.5% to 3.0% for other abnormal rhythms. False-negative rates varied from 12.0% to 7.5%, 9.9% to 2.7%, and 55.9% to 30.5%, respectively. Flagging of ACS varied by a factor of 2.5 between programs. Physicians flagged more ECGs for prompt review, but also showed variance of around a factor of 2. False-negative values differed between programs by a factor of 2 but was high for all (>50%). (De Bie et al., 2020, p.143)

The results point to the importance of not relying solely on the electronic interpretation due to inconsistency among programs and the importance accurate interpretation has on patient outcomes,.

A quasi-randomized trial conducted in 2009 with 105 internal and emergency medicine residents also demonstrates the impact of computer misinterpretation on provider decision making and inherently patient outcome. In this trial participants were briefed with a case study randomly chosen from a concealed stack of handouts, some of which had an erroneous ECG computer interpretation printed on the ECG while others had no computer interpretation. While this difference did not significantly affect the participants ECG interpretation, the participants whose ECGs had erroneous computer interpretations were more likely to recommend revascularization versus those who did not have the erroneous interpretation (30% v. 10%, p=0.01). Southern and Arnsten (2009) concluded from this research that only measuring the impact of computer interpretation on provider interpretation could "underestimate the effect of computer misinterpretations on clinical decision making" (p.372).

Computer interpretation, as demonstrated by the previous authors, can give incorrect readings and occasionally miss "red-flag" clues to serious diagnoses. In the same vein, according to Bond et al. (2018), what has been defined as an automation bias may occur in the interpretation of ECGs. Because there is an automated diagnosis (AD) when the ECG is analyzed by the computer, providers often utilize this AD when computing their own diagnoses. All providers must be confident in their interpretation abilities, which is rooted in continued, repeated practice. In this study, when shown an incorrect AD, cardiology fellows' and non-cardiology fellows' accuracy of interpretations decreased by 43.20% and 58.95%, respectively (p>0.001). This also demonstrates that non-cardiology specialists tend to concur more with the AD rather than through independent interpretation.

The importance of ability to interpret an ECG, while essential, is under-taught. This skill needs more attention while in and beyond school. Pontes et al. (2018) conducted a literature review across six electronic databases regarding ECG learning tools, which then paired down to 17 articles. Of the articles examined, 52.9% of software types were tutorial and 58.8% were designed to be run locally on a computer. One of the main conclusions of this literature review was that introducing educational software for ECG teaching yielded positive results, though the authors did note that higher quality research methodologies are needed to provide more explicit conclusions.

While there is not a single, agreed upon method for additional ECG teaching at this point. There is evidence to support multiple teaching types, though one of the most accessible is one that is available on a technological device such as a computer or smart phone. During the 2012-2013 school year 148 medical students and 35 Emergency Medicine residents participated in an online interactive module training. The participants demonstrated significant learning progress with the students' scores increasing from 5.9 (95% CI [5.7–6.1]) to 7.3 (95% CI [7.1–7.5]), with a mean difference of 1.4 (95% CI [1.12–1.68]) ($p<0.0001$). Medical residents also improved their scores 6.5 (95% CI [6.2–6.9]) to 7.8 (95% CI [7.4–8.2]) ($p<0.0001$). Pourmand et al. (2015) concludes that with the use of this educational technology participants were able to improve their ability to specifically interpret and thus diagnose acute myocardial infarction.

Another recent study in Advances in Health Sciences Education publication supports the need for continued and varied education specific to ECG interpretation. Hatala et al. (2019) found that "performance increased with practice…our results support a preliminary validity argument for a learning curve assessment approach for repeated ECG interpretation with deliberate and mixed practice" (p. 45). While the goal of this particular study was to focus on "how well is each learner learning" it also points to the need of constant and consistent practice for this specific area of diagnostic interpretation.

Conceptual Framework

This quasiexperiment follows The Promoting Action on Research Implementation in Health Services (PARIHS) framework. The goal of this framework is to bring evidence into a contextualized manner to then be facilitated into practice; “that successful implementation of research in practice is a function of the relation between the nature of the evidence, the context in which the proposed change is to be implemented and the mechanisms by the which the change is facilitated” (Kitson et al., 1998, p.149). Because we know that furthering ones education leads to greater mastery of a topic, there was the initial belief that any time spent utilizing a learning program would aid in one’s ability to better interpret EKGs. Some key pieces of the framework that were kept in mind throughout this project were: diversified and strong evidence, helping to meld the current evidence into the novel learning application and then appropriately facilitating its use amongst an appropriate cohort (Rycroft-Malone, 2004). There are strengths and weaknesses within this framework, yet it was felt that it could be morphed to help bring the existing evidence into practice and continue to support this learning application post experiment (Ullrich et al., 2014).

Methodology

The quasiexperimental study for a six-week intervention with the novel ECG learning application included descriptive pre- and post-tests. Prior to the 6-week involvement with the ECG learning application, each participant completed a pre-test and diagnostic test. Participants were then enrolled in a 6-week program utilizing the ECG application. After finishing the 6-week program, participants then completed a post-test and the same diagnostic test.

Design

The pre-test included two preparation/confidence questions: 1) *How prepared do you feel to interpret an ECG?* and 2) *How confident are you in your ability to interpret an ECG accurately?* These same preparation/confidence questions are asked prior to the final diagnostic test. The diagnostic test is a set of ten ECGs, each with multiple choice questions regarding: rate, rhythm regularity, axis, intervals, PR interval, and QRS complex. The 6-week program consisted of weekly assignments. Each weekly assignment included five ECG 12-lead readings and corresponding questions regarding the same attributes introduced during the first diagnostic test (see Appendix B). The participant could also choose to focus on particular attributes each week based on areas they wanted to improve upon. As the participant completed each of the five questions an immediate grading is done, thus giving feedback at the end of each question. This allowed the participant to gauge how they are doing throughout each weekly assignment (see Appendix C).

Additionally, when the assignment was completed for the week, the participant could go back and review any question and corresponding ECG reading they choose (Appendix D). This summary page showed an overall score, percentage correct, which questions had incorrect answers (distinguished clearly in highlighted red) and a breakdown of percentage correct corresponding to each individual attribute.

There were 78 different 12-lead ECG readings in the application that were randomly cycled through to create the weekly assignments. The diagnostic tests were set questions; thus they could be compared against one another and across participants.

The ECG Application

This novel application was designed to promote learning and confidence in future and current healthcare providers when interpreting an ECG. It is the “brain-child” of friends, now colleagues from different educational and career backgrounds: Timothy Firman, MD and Charles Brown, an engineer. Firman is currently in his first year of residency, after graduation in 2020, in Emergency Medicine at the University of Chicago. Brown is the Senior Director of Engineering at Mavenlink, a San Francisco based project management software platform. The two created the initial prototype as a fulfillment for Firman’s final doctoral project at the University of California San Diego School of Medicine. With continued excitement, knowledge of the importance of interdisciplinary work, and increasingly busy schedules, this author, currently a registered nurse working on an inpatient Hematology/Oncology unit and in the final year of a doctoral nurse practitioner program, joined the team in a development role. The application was completely re-written, expanded to include more data, thus making it appropriate for this quasiexperiment. Prior to its utilization in this project, the application had not been operated by students. Preparing the application for use to find out whether or not it could significantly improve an individual’s ability to interpret ECGs was a process that took place over many months of trial and error with the three contributors collaborating to not only expand the library within the application, but also improve the user experience prior to bringing it to a larger population of users.

As a team, it is felt that the collaboration on this application is something that is incredibly valuable and should take place across healthcare in an effort to improve the ability of healthcare professionals and outcomes for patients.

IRB Review and Informed Consent

The Seattle University Institutional Review Board determined this project to be "Not Human Subjects Research." Thus, it was exempt from IRB review. Informed consent to participate, including explanation of the option to withdraw at any time without penalty, was obtained from all participants prior to starting the pre-test and diagnostic test. All potential project participants recruited are of adult age.

Setting and Recruitment of Participants

This study took place remotely amongst a convenience sample of students from the DNP cohort of 2021 at Seattle University College of Nursing. Inclusion criteria: the participant is part of the 2021 cohort of nurse practitioner students at Seattle University College of Nursing, regardless of track (Acute Care: Adult-Gerontology Acute Care, Primary Care: Adult-Gerontology, Family Practice, Family Psychiatric Mental Health and Certified Nurse Midwifery). Participants were recruited via email to take part in a 6-week study regarding an EKG learning tool. Once informed consent was obtained, participants could elect to complete the program from the comfort of their home or other location where they had the ability to connect to the Internet. Informed consent was documented through a consent page that was part of the application (see Appendix A). Additionally, all personal information of the participants were de-identified once they entered a new username into the application.

There was one exclusion criterion that precluded data analysis: not completing the six-week period of learning. Individuals' data were excluded if from analysis if they did not complete the 6-week period of learning. The only data analyzed comes from individuals who completed the entire program.

A $50 gift card was presented at random via raffle upon completion of the program. This raffle award was available to two participants.

Cultural and Ethical Considerations

Nursing graduate students have a notoriously busy and stressful schedule (Stillwell et al., 2017). Participating in this study was certainly an additional request of them during what can be a demanding period. The timing of the study was decided about after careful consideration of the school's course schedule. The participant could begin their six-week program within the four weeks after the close of the Fall quarter at Seattle University, allowing for full attention to be given to academic courses required for graduation. This allowed for ample attention to be paid to their Seattle University-related studies while not contributing additional stress. Ideally, the timing of the project may also positively prepare the participant for upcoming licensing boards post-graduation.

Data Analysis

All data was analyzed using Microsoft Excel. Specific quantitative analysis was used to measure pre- and post-test confidence and performance scores separately, which includes the mean score and its standard deviation. Additionally, the differences, mean differences, and standard deviation in the Likert-type scale responses were determined.

Results

Between December 2020 and March 2021, 35 students signed up and started the program. At the end of the program, six participants completed the entire six-week program including all confidence questions and pre- and post- diagnostic tests.

Confidence Questions

The mean response to pre intervention question 1: *"How prepared do you feel to interpret an ECG?"* was 1.83 ± 0.4 (SD) on a 5-point Likert scale. In comparison, the post intervention response to the same question increased to a mean score of 3 ± 0.6 (SD). Of the six participants, five of six responses increased with a mean of 1.17.

Table 1a: *Confidence Question 1*

Participant #	*Pretest response*	*Posttest response*	*Difference*
1	2	4	+2
2	2	3	+1
3	1	3	+2
4	2	3	+1
5	2	3	+1
6	2	2	-

The mean response to pre-test question 2: "*How confident are you in your ability to interpret an ECG accurately?"* was 1.7 ± 0.5 (SD), which increased to a mean of 3 ± 0 (SD) in the post-test. All six participants answers increased with a mean of 1.33.

Table 1b: *Confidence Question 2*

Participant #	*Pretest response*	*Posttest response*	*Difference*
1	2	3	+1
2	2	3	+1
3	1	3	+2
4	1	3	+2
5	2	3	+1
6	2	3	+1

Diagnostic Tests

All six participants improved their overall score from the first diagnostic test to the second. The mean score of diagnostic test 1 was 68% ± 7.5 (SD) while the mean score of the diagnostic test 2 was 80% ± 3.7 (SD). This demonstrates an approximate 12% overall improvement in interpretation of ECGs. Notably, participant 6 had the smallest difference in score improvement, but they also exhibited the highest score of all the participants on diagnostic test 1 at 76%. Moreover, participant 6 scored just below the median score of diagnostic test 2 (78.5%) at 78%.

Table 2: *Diagnostic Test Scores*

Participant #	*DT 1 Score*	*DT2 Score*	*% Difference in Score*
1	72%	83%	+11%
2	69%	81%	+12%
3	60%	79%	+19%
4	57%	74%	+17%
5	72%	84%	+12%
6	76%	78%	+2%

*scores rounded up from nearest tenth

Discussion

Limitations

There were several limitations of this study, the first being the sample size. While there were high-hopes established with the 35 individuals that initially began, the six-week course proved to weed out many participants, resulting in a final n=6. The inclusion criteria for the results was to complete the course in its entirety. The high dropout rate (87.5%) could lead to nonresponse bias, thus the participants that did participate are not representative of the DNP cohort itself (McFarlane et al., 2007).

It is understood that results from small sample sizes (e.g., n=<10) results are often unstable. Additionally, the small sample size makes the results less likely to reliably reflect the true population mean (LoBiondo-Wood & Haber, 2014). This author is hopeful this study can be considered a pilot study that can be augmented and replicated to fit a larger scale with a more diverse sample population.

As noted previously in this paper, the cohort that was invited to participate in this study were in their final year of a four-year DNP program. That being said, it was a notoriously busy time in their student lives. Additionally, as is the nature of a nurse practitioner program, many of these students were concurrently working either full or part time as registered nurses throughout this program and during this time. Perhaps there may have been a greater number of participants had this program taken place during a school break. Moreover, coordination efforts for this particular study were conducted remotely due to the pandemic.

This sample population from the Seattle University 2021 DNP cohort is not representative of the target population which would be across disciplines, from different schools, etc. Rather, this population is an accessible and convenient sample. It should be acknowledged, as noted by LoBiondo-Wood & Haber (2014), that the risk of bias is greater with a convenience sample than with any other type of sample.

The specific resources used to develop the ECGs present as part of the application had not been formally validated for this purpose though they were used during previous lectures for teaching students.

Dissemination of Results

A summary of the results will be presented at the conclusion of all analysis. Currently, the stakeholders are those that have been involved in the design of the application as well as the future participants. All data will be disseminated to said stakeholders upon completion of the study and analysis consummation. Data and conclusions from this study will also be presented via PowerPoint to all interested parties within the Seattle University College of Nursing June 11, 2021.

Summary and Implications for Clinical Practice

As noted by several studies and compositions cited, the importance of being able to efficiently and correctly interpret an ECG independent of the computerized reading is not only important for providers to give appropriate care, but necessary to improve patient outcomes. This novel learning application demonstrated an improvement in ability based on results of diagnostic testing pre- and post-intervention. It also revealed an increase in confidence among the participants. So, not only did participants improve their ability to accurately interpret ECGs, they also improved their confidence in that ability. This translates into practice specifically when we discuss the automation bias that occurs amongst providers when reading what the computer has interpreted the rhythm as. Theoretically, if an individual is more confident in how well they can interpret an ECG, they will be better able to correct for automation bias.

More education needs to be provided to individuals expected to interpret ECGs as part of their scope of practice. The results of this quasiexperiment point to improved ability and confidence with practice. This is just one novel learning application. It is known that individuals have various learning preferences, thus varied learning avenues are important in training for students and professionals to interpret ECGs.

There is certainly room for study replication on a grander scale, as it would allow for more statistically significant and reliable results. There is room to expand the targeted population to medical, nursing, and physician assistant students. Ideally, this learning application could gain exposure among the professionals in these fields as well. It is the opinion of this researcher that additional studies should be conducted within the field, specifically around ECG learning tool expansion.

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Appendix A

Electrocardiogram Education   Admin Panel   Dashboard   Log out

CONSENT TO PARTICIPATE IN RESEARCH

Lead investigator: Hailey E. Bobin Cole, Seattle University College of Nursing. (206) 459-2237 Faculty advisor: Dr. Therry Eparwa, Seattle University College of Nursing. (206) 296-2344

You are being asked to participate in a study that evaluates how an EKG teaching tool affects your ability to interpret electrocardiogram (EKG) readings and your confidence in EKG interpretation. You will be asked to complete and pre- and post- tests related to EKG interpretation. Your will work with the EKG teaching tool for up to one (1) hour once a week for six (6) weeks. You will answer two additional questions at the beginning and at the end of your experience.

This study is being performed as partial fulfillment of the requirements for the Doctor of Nursing Practice degree at Seattle University.There are no known risks associated with this study. The questions are designed to understand your experience with the teaching tool. We do not anticipate that this teaching tool will cause discomfort. However, if at any point the questions become distressing, you may stop at any time.

A benefit of this study relates to understanding if the EKG teaching tool is effective in affecting a student's ability to interpret EKGs and/or confidence surrounding the abilities to do so. Participants may potentially benefit by having an increase in ability and confidence in EKG interpretation.

Participants who complete the duration of the 6-week study will be entered into a drawing for 1 of 2 $50 gift cards. We appreciate all participation and are hopeful the experience in itself is also an incentive for all.

Your name will only be collected in order to sign the consent forms. After that you will have a coded identifier that will be used instead of your name. Demographic information will be requested on an online survey that includes age, race, gender, income status. This is voluntary information and you do not need to respond if you do not wish. Your name will never be used in any public dissemination of these data (publications, presentations, etc.). All research materials and consent forms will be encrypted, stored electronically on a non- public computer protected by a password. The data will be available to myself only. Human subjects research regulations require that data be kept for a minimum of three (3) years. When the research study ends, any identifying information will be removed from the data, or it will be destroyed. All of the information you provide will be kept confidential.

Your participation in this study is voluntary. You may withdraw your consent to participate at any time without penalty. Your withdrawal will not influence any other services to which you may be otherwise entitled.

Your participation in this study is voluntary. You may withdraw your consent to participate at any time without penalty. Your withdrawal will not influence any other services to which you may be otherwise entitled.

A summary of the results of this research will be supplied to you, at no cost, upon request. My contact information is: Hailey Bobin Cole at (206)-459-2237 and bobinh@seattleu.edu. Summary of results should be available by May 2021.

I have read the above statements and understand what is being asked of me. I also understand that my participation is voluntary and that I am free to withdraw my consent at any time, for any reason, without penalty. On these terms, I certify that I am willing to participate in this research project.

I understand that should I have any concerns about my participation in this study, I may call Hailey Bobin Cole who is asking me to participate, at (206)-459-2237. If I have any concerns that my rights are being violated, I may contact Dr. Michael Spinetta, Chair of the Seattle University Institutional Review Board at spinetta@seattleu.edu or (206) 296-5951.

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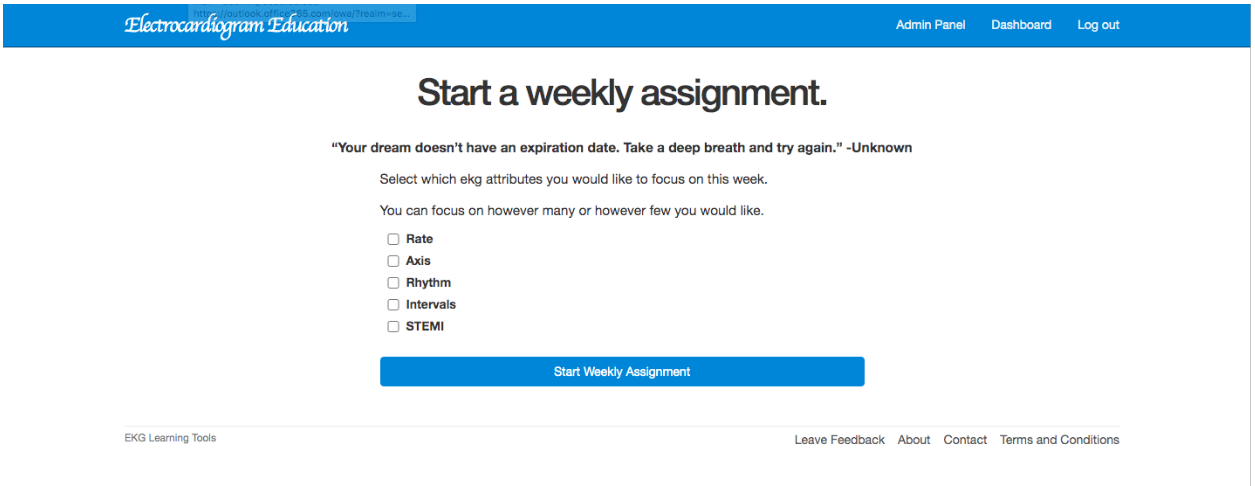
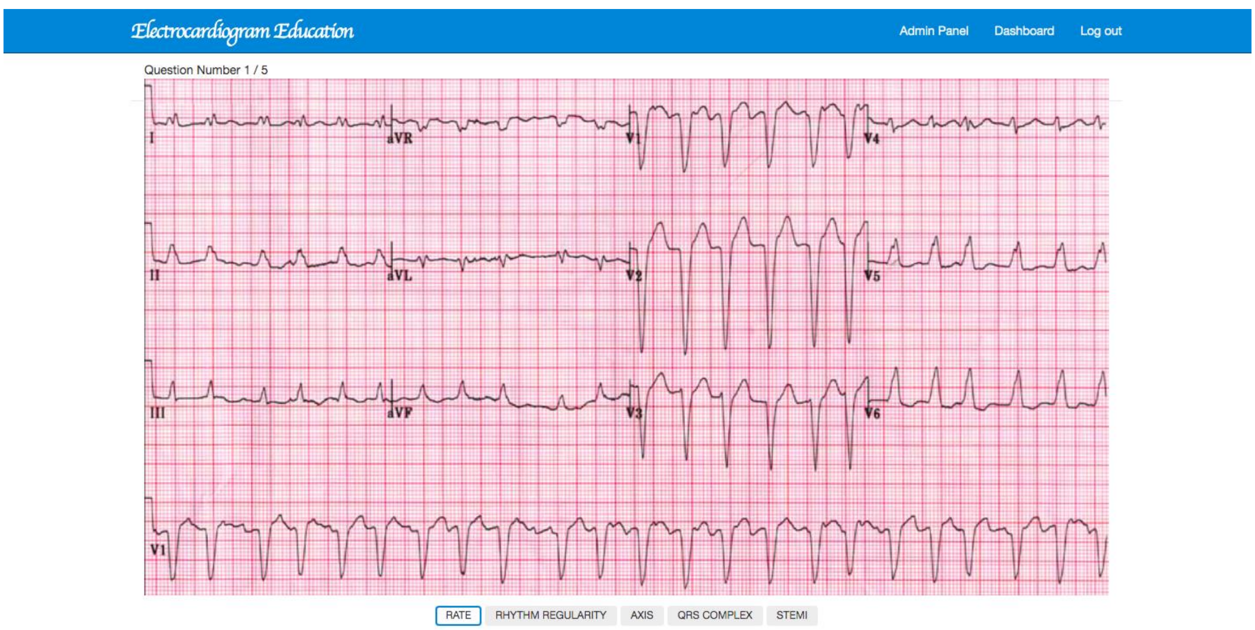
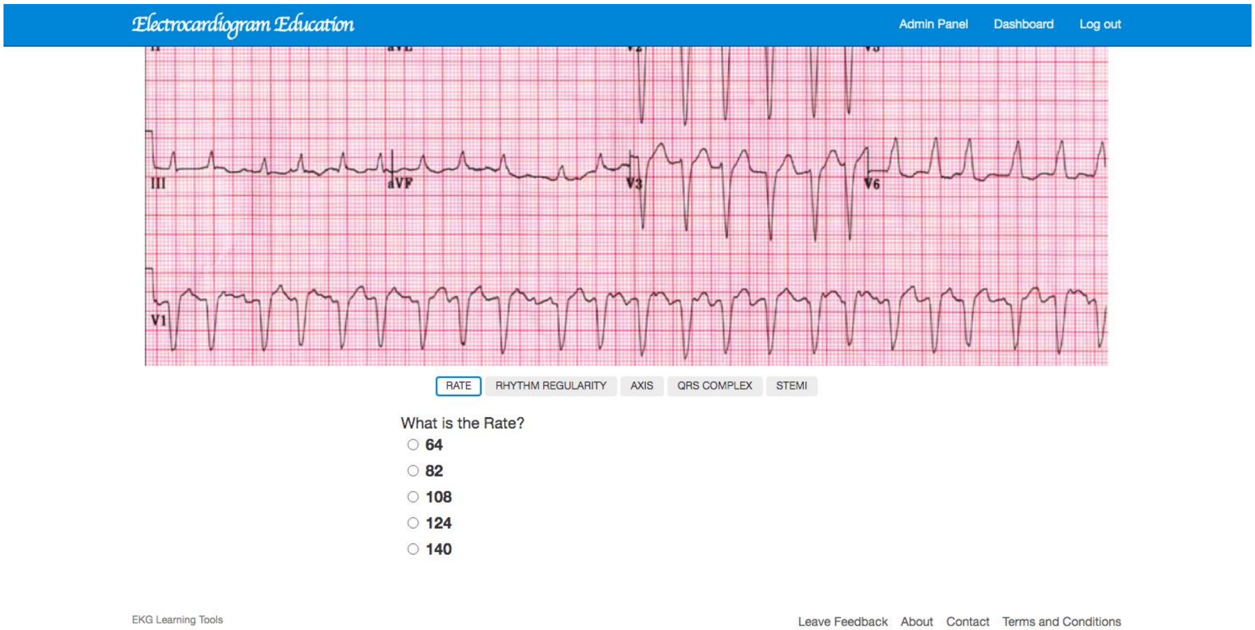
Appendix B


Electrocardiogram Education
Admin Panel
Dashboard
Log out
Start a weekly assignment.
"Your dream doesn't have an expiration date. Take a deep breath and try again." -Unknown
Select which ekg attributes you would like to focus on this week.
You can focus on however many or however few you would like.
Rate
Axis
Rhythm
Intervals
STEMI
Start Weekly Assignment
EKG Learning Tools
Leave Feedback
About
Contact
Terms and Conditions


Electrocardiogram Education
Admin Panel
Dashboard
Log out
Question Number 1 / 5
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
V1
RATE
RHYTHM REGULARITY
AXIS
QRS COMPLEX
STEMI


Electrocardiogram Education
Admin Panel
Dashboard
Log out
III
aVF
V3
V6
V1
RATE
RHYTHM REGULARITY
AXIS
QRS COMPLEX
STEMI
What is the Rate?
64
82
108
124
140
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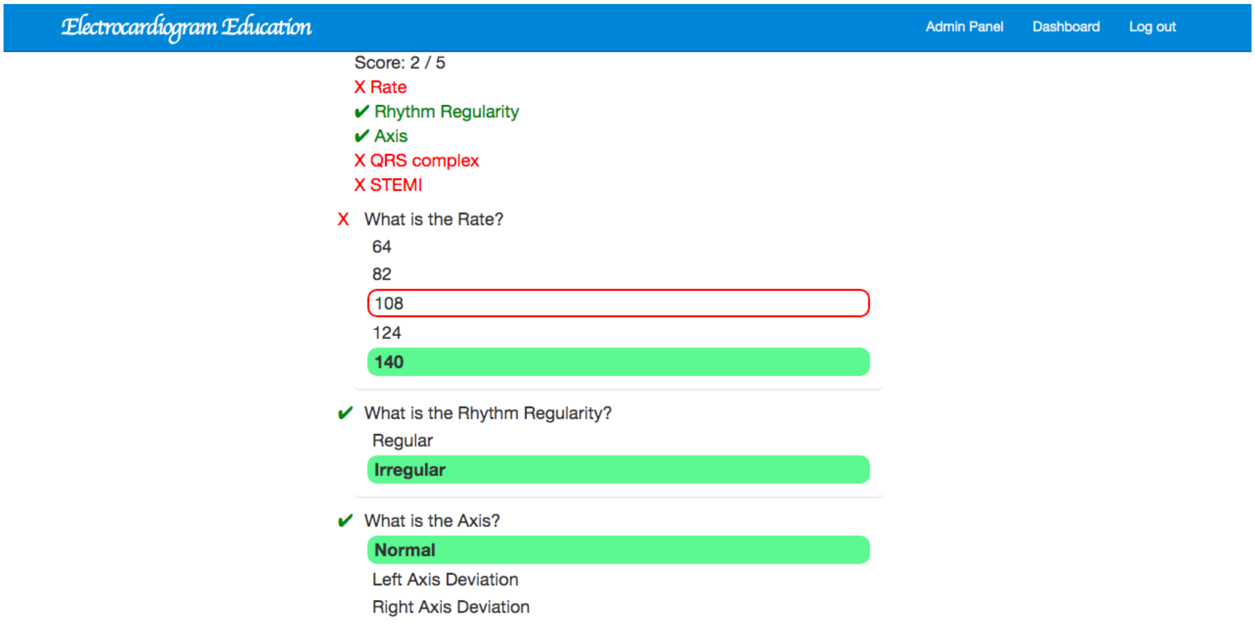
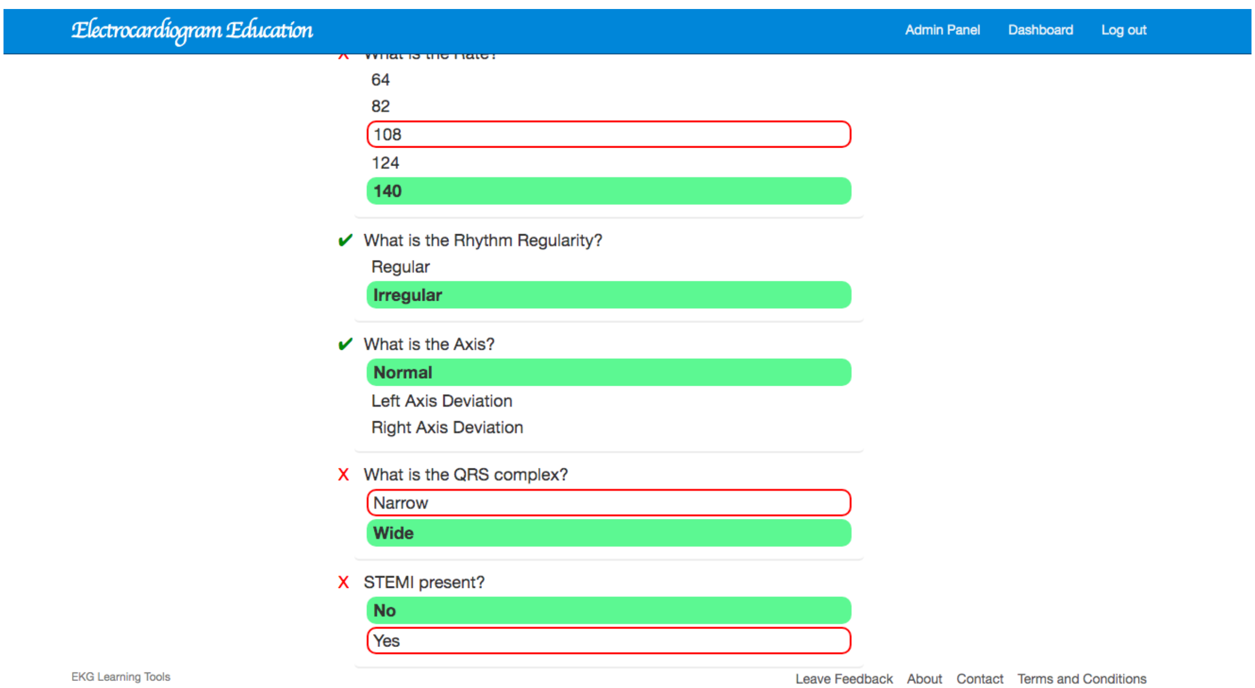
Appendix C


Electrocardiogram Education
Admin Panel
Dashboard
Log out
Score: 2 / 5
X Rate
✔ Rhythm Regularity
✔ Axis
X QRS complex
X STEMI
X What is the Rate?
64
82
108
124
140
✔ What is the Rhythm Regularity?
Regular
Irregular
✔ What is the Axis?
Normal
Left Axis Deviation
Right Axis Deviation


Electrocardiogram Education
Admin Panel
Dashboard
Log out
64
82
108
124
140
✔ What is the Rhythm Regularity?
Regular
Irregular
✔ What is the Axis?
Normal
Left Axis Deviation
Right Axis Deviation
X What is the QRS complex?
Narrow
Wide
X STEMI present?
No
Yes
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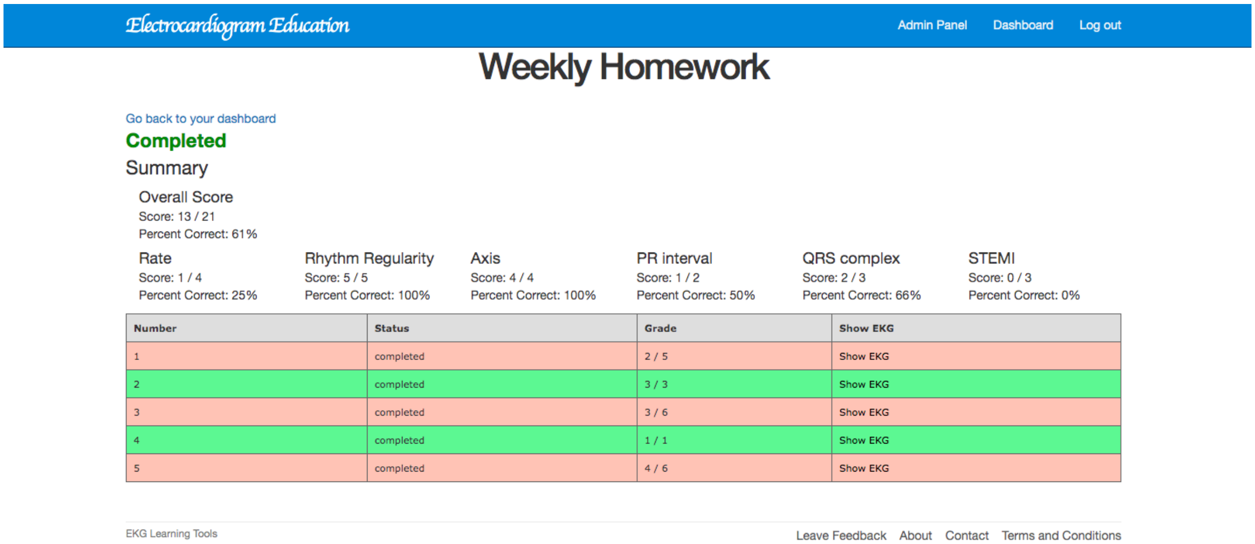
Appendix D



Electrocardiogram Education — Admin Panel — Dashboard — Log out

Weekly Homework

Go back to your dashboard

Completed

Summary

Overall Score
Score: 13 / 21
Percent Correct: 61%

Rate
Score: 1 / 4
Percent Correct: 25%

Rhythm Regularity
Score: 5 / 5
Percent Correct: 100%

Axis
Score: 4 / 4
Percent Correct: 100%

PR interval
Score: 1 / 2
Percent Correct: 50%

QRS complex
Score: 2 / 3
Percent Correct: 66%

STEMI
Score: 0 / 3
Percent Correct: 0%

Number	Status	Grade	Show EKG
1	completed	2 / 5	Show EKG
2	completed	3 / 3	Show EKG
3	completed	3 / 6	Show EKG
4	completed	1 / 1	Show EKG
5	completed	4 / 6	Show EKG

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