Formative Evaluation Phase of Instructional Design Model

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**Purpose of Formative Evaluation**

Formative evaluation occurs during the entire instructional design process (analysis, design, and development). However, it is usually carryout in the design and development phase and prior to the implementation phase of the instructional design model. The main goal of formative evaluation is to improve design and development. That is, formative evaluation is used to test the instructional materials. Data collection is utilized in the process to identify necessary revisions in instructional materials (Branch & Merrill, 2012). In addition to data collection, the revision stage occurs concurrently with the data collection stage (Weston, McAlpine, & Bordonaro, 1995).

Although the main purpose of formative evaluation is to improve design and development, the process should have an intended goal. The goal can be related, but not limited, to the instructional materials’ “effectiveness, efficiency, and [/or] appeal” (Weston et al., 1995, p. 30). Thus, the design of the evaluation should provide feedback about the goal(s) in the formative evaluation process. The goal for the formative evaluation phase in this project was to gather information about the intrinsic component of the instruction (completeness and accuracy of content material, appeal of teaching and/or implementation strategies, quality of media, and validity and reliability of assessment).

**Characteristics of Participants**

Expert Review

The expert review in this formative evaluation phase was a subject matter expert. “Subject matter experts (SMEs) may provide feedback on issues such as accuracy, comprehensiveness and timeliness of the materials, and target population experts (TPEs) on appropriateness of materials for the audience” (Weston, Maistre, McAlpine, & Bordonaro, 1997, p. 370). The individual recruited in this project as the subject matter expert was a secondary mathematics teacher, who has over 6 years of experience teaching mathematics. The participant is another AP Calculus teacher and has more than 5 years of experience teaching Calculus AB and BC.

One-to-One Evaluation

According to Dick (1980), the initial stage of formative evaluation was suggested to be conducted with at least three individuals who are representative of the targeted population. Therefore, seven high school AP Calculus AB students were recruited to participate in the one-to-one evaluation. During the one-to-one evaluation, the evaluator worked directly with each participant to gather information about clarity, impact, and feasibility (Kowch, 2002). These students have already been taught all the topics in the AP Calculus AB course. During the formative evaluation process these students have already taken the AP exam for this academic school year. Furthermore, the students recruited were representative of “above average, average, and below average” (Dick, 1980, p. 5). For this project, above average corresponded to earning a B or higher in the course, average correspond to earning a C, and below average referred to earning a D or F in the course. There were 1 above average, 3 average, and 3 below average participants.

**Materials and Instruments**

There were two instruments, open-ended questionnaire and electronic questionnaire, that were developed for the formative evaluation process. Each instrument was utilized for different stage of the review process. The open-ended questionnaire, see Appendix A, was developed for the subject matter expert to respond to during the formative evaluation of the instructional materials. Open-ended questions enable a respondent to provide valuable information that about what is most important (McMillan, 2016). In this case, the subject matter expert’s specific comments and/or suggestions about the content materials is crucial for any necessary revision.

The second instrument developed was an electronic questionnaire that used for the one-to-one review. It was developed via Google Form and the link was <http://goo.gl/forms/hsMbvwCIC0tcfGDr2>. The questionnaire was an “attitude, value, and interest questionnaires” (McMillan, 2016, pg. 182) that was in the form of a Likert scale. The scale ranged from *Strongly Disagree* to *Strongly Agree*, with a middle option of *Neutral.* The four main categories for review were the website, video, handout/practice problems, and the end of the lesson assessment. In addition to the Likert scale items, there was one open-ended response to solicit students’ comments or suggestions for improvement on any of the instructional materials.

**Evaluation Procedures**

Expert Review Procedure

The participant in the expert review was a subject matter expert. The participant was sent an email explaining the purpose of the review and directions. The open-ended questionnaire, along with two attachments (solutions to the Handout/Practice Problems and End of Lesson Assessment), and the video link embed in the AP Review page on the class website (<http://xiong101.weebly.com/ap-review.html)> were included in the email. The participant was asked to review the following items, which was linked in the AP Review page on the class website: Lesson , Video, Handout/Practice Problems and Solutions, and End of Lesson Assessment and Solutions. Furthermore, the participant was asked to filled out the questionnaire either electronically or written during the review process.

One-to-One Evaluation Procedure

The participants recruited to take part in the one-to-one evaluation were 7 high school AP Calculus AB students. During the process, the evaluator explained the purpose of the formative evaluation process and went through all the instructional materials with the students individually. Students were given a Chromebook and paper copy of the Lesson Plan, Handout / Practice Problems, and End of Lesson Assessment. They were then asked to go to the class website and open up the electronic questionnaire in a second tab (the link was posted on the class blog page) and response to each items after the evaluator goes through that specific instructional material. The link to the electronic questionnaire was <http://goo.gl/forms/P6xH0uu5S8CmQGLj1> .The evaluator did not move onto the next instructional materials until the student completed the corresponding item on the questionnaire. The following items were the sequence in the instructional materials were presented: the class website (AP Review page), Lesson Plan / Facilitator Guide, Video, Handout / Practice Problems, and End of Lesson Assessment. Upon completion the electronic questionnaire and reviewing of the instructional materials, students submitted their response. Since the electronic questionnaire was created by a Google Form, their responses were automatically recorded on a Google Sheet.

**Data from Evaluation**

Data from Expert Review

The subject matter expert felt the instructional materials for this project was very good, see Appendix B: Subject Matter Expert’s Response. There were no suggestions for changes or improvement in terms of content, for the Handout / Practice Problems, technical aspect of the video, or the End of Lesson Assessment. There were two recommendations that the subject matter expert provided. One recommendation was given for the Lesson Plan / Facilitator Guide. The participant recommended to “discuss what the teacher is doing while students are collaborating or participating in the Rally coach.” The second recommendation was for the video and it was to “instruct student to pause the video to summarize their thoughts with a partner or in writing.”

Data from One-to-One Review

Based upon students’ response in the electronic questionnaire, most of the students *Agree* that the website was appealing and efficient, see Chart 1: Review of the Website. Majority of the student *Agree* that the website’s font size was reasonable, and the site was organized and easy to navigate. Technical problems that arose and students commented on were that video link on YouTube was blocked and the Handout / Practice Problems link did not open.

Most students *Strongly Agree* that content in the video and instruction were clear and the technical aspect (such as audio, length, and font size) were reasonable. Most student *Agree* that the pacing of the video was reasonable and its colors were appealing. Most students *Disagree* that there were typographical or grammatical errors in the video. Four students provided comments or suggestions on the video. Student 2 commented that they don’t have any complaints about the video but “worried there will be other students who perceive the video as boring or dull.” Student 5suggested to start the video by saying "Hi, I'm Ms. Xiong and today we'll be learning about \_\_\_\_ " because it just makes them more likely to continue to watch any tutorial video. Student 6 commented in the open-ended response, “Some parts in the video moved too fast for myself to read.” Student 7 did not like the watermark in the video and suggested to use a different online software to create the video.

The majority of the students *Agree* that the instruction in the Handout / Practice Problems were complete. The majority of them also indicated that they *Agree* directions and content was clear in the Handout / Practice Problems. Like the video, most students *Disagree* that there were typographical or grammatical errors in the End of Lesson Assessment. Furthermore, Student 3 suggested to divide the problems in the Hand out in the following manner: “The problems on the worksheet could be 2 problems with the teacher, 2 problems with a partner, and 2 problems by yourself in that order to allow students to understand material and gain confidence in them.”

For the End of Lesson Assessment, most students *Agree* that the number of questions was reasonable, it assessed the learning objective in the lesson, and that the directions were clear. Similar to the video and Handout / Practice Problems, most students *Disagree* that there were typographical or grammatical errors in the End of Lesson Assessment. Student 5 suggested reducing the number of questions in the End of Lesson Assessment from 3 to 2 or even 1due to the time of the day of the course (6thperiod) and 3 seemed to be a lot.

**Revision**

Revision is the stage the occurs concurrently or after formative evaluation. According to Piskurich (2015) *“as-needed* and *planned”* (p. 338) are the two kinds of revision. For this project, the *as-needed* revision were made immediately because these revisions are minor and require little time. On the other hand, the *planned* revisions are change that will be made at a later time because they require more time and planning in comparison to *as-needed* revisions.

The following changes were made immediately after collecting data. The video link to YouTube was unblocked by approving the video for students to access on the school network. The Lesson Plan / Facilitator Guide, Handout / Practice Problems, and End of Lesson Assessment were re-upload as PDF instead of Word document to preserve any math equations and to ensure that the links are working on students’ Chromebook.

The following are changes will be made at a later time based on data collection. In the Lesson Plan / Facilitator Guide, discuss or include what the instructor is doing while student are collaborating or participating in the instructional activities. The second change will be to edit the video to include directions in the video to pause and have students summarize and process the information. The third change will be to incorporate 1 additional examples in the Handout / Practice Problem to have students practice individually prior to moving into the Rally Coach activity.

**Reflection**

In this course I enjoyed learning about the Instructional Design (ID) Process at a higher and in depth level. I learned that the ID process takes time but had provided met with a structured process for developing effective instructional materials (which as a secondary mathematic teachers I was not aware of and never had to go through). I also learned about how literature review and instructional design theories play an important role in guide me in making decision in the entire instructional design process. I also enjoyed learning a new technology skill, which was also a challenge for me. In this class, I was challenged to create a video using PowToon, an online website that I’ve never used before. I had to utilized lot of tutorial video to assist me while creating my instructional video. I plan to use the knowledge of the ID process to assist me in creating future instructional materials in my classroom. Now that I have some experience creating instructional material for this particular lesson, I will build upon it by utilizing the ID process to developing the other two lesson prior to this particular one for my AP Calculus AB students.

References

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APPENDIX A: Subject Matter Expert Open-Ended Questionnaire

Thank you for taking the time to assist me in reviewing the lesson that I developed for reviewing position of a particle (in preparation for the AP exam). The purpose of this review is to provide me feedback about the content materials I developed. Please complete this form with detail and specific comments/suggestions. Your comments /suggestions are valuable in helping me develop the effective instructional materials.

- Mai Y. Xiong

**Subject Matter Expert Review**

1. Review the lesson plan/facilitator guide for teaching/implementation information.

* Is the teaching/implementation information appealing to learners & teachers? If not, please explain and provide suggestion for improvement.
* Is the teaching/implementation information fit for reviewing for the AP exam? If not, please explain and provide suggestion for improvement.
* Is the teaching/implementation information easy to use? If not, please explain and provide suggestion for improvement.

2.  Review the material (video, handout/practice problems) for completeness and accuracy of content.

* Is the content about finding position of particle in rectilinear motion accurate? If content is not accurate, please provide suggestion for improvement.

3. Review the video for technical aspect.

* Is the audio in the video too low or too high? Please explain and provide suggestion for improvement.
* Is the audio in the video clear? Please explain and provide suggestion for improvement.
* Is pacing of the video too fast or too slow? Please explain and provide suggestion for improvement.

4. Review the end of lesson assessment.

* Is the assessment valid and reliable? If not, please explain and provide suggestion for improvement.

APPENDIX B: Subject Matter Expert’s Response

Thank you for taking the time to assist me in reviewing the lesson that I developed for reviewing position of a particle (in preparation for the AP exam). The purpose of this review is to provide me feedback about the content materials I developed. Please complete this form with detail and specific comments/suggestions. Your comments /suggestions are valuable in helping me develop the effective instructional materials.

- Mai Y. Xiong

**Subject Matter Expert Review**

1. Review the lesson plan/facilitator guide for teaching/implementation information.

* Is the teaching/implementation information appealing to learners & teachers? If not, please explain and provide suggestion for improvement.

The video is great! The only thing I would suggest for improvement in the implementation would be to discuss what the teacher is doing while the students are collaborating or participating in the Rally coach. Is the teacher walking around and evaluating students’ discussions? Is the teacher helping struggling students? Is the teacher working with on the side that are really struggling? I think for a teacher that would be an important thing to know.

* Is the teaching/implementation information fit for reviewing for the AP exam? If not, please explain and provide suggestion for improvement.

It is definitely fit for reviewing for the AP exam. I wish you had shown it to me earlier. I would have borrowed it.

* Is the teaching/implementation information easy to use? If not, please explain and provide suggestion for improvement.

It is very easy to use. The one thing I might do , since the video is very thorough, is to instruct students to pause the video to summarize their thoughts with a partner or in writing.

2.  Review the material (video, handout/practice problems) for completeness and accuracy of content.

* Is the content about finding position of particle in rectilinear motion accurate? If content is not accurate, please provide suggestion for improvement.

It is accurate and the rubrics align to the way that A.P. has their grading rubrics for the Free Response Questions.

3. Review the video for technical aspect.

* Is the audio in the video too low or too high? Please explain and provide suggestion for improvement.

The audio is fine. The only thing I would suggest, since there is a lot of content and the video is very thorough, is to instruct students to pause the video to process pieces of the information at appropriate times.

* Is the audio in the video clear? Please explain and provide suggestion for improvement.

Audio is clear.

* Is pacing of the video too fast or too slow? Please explain and provide suggestion for improvement.

Since there is a lot of content, it can be too fast for some learners that are more kinesthetic. I would have places to pause the video with questions for students to either write about or discuss with a partner so that they can synthesize the information.

4. Review the end of lesson assessment.

* Is the assessment valid and reliable? If not, please explain and provide suggestion for improvement.

No suggestions for improvement. It looks great.

Chart 1

Chart 2

Chart 3

Chart 4