Assignment 2: Planning for Effective Integration of Technology in the Curriculum

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Introduction

In today's classrooms, students increasingly expect technology-facilitated learning activities that are not easily accommodated through traditional instruction (Kim, 2016). To meet these expectations, teachers have recognized the need to adapt conventional lessons by using technology integration frameworks. These frameworks not only help identify the level of technology use in the classroom but also support the design of lessons that incorporate technology to enhance student autonomy and engagement.

Frameworks such as the Technology Integration Matrix (TIM)(Appendix A) and the ASSURE model are valuable tools that enable teachers to achieve these objectives. The Technology Integration Matrix provides a clear structure for evaluating and improving the use of technology in the classroom. Similarly, the ASSURE model offers a systematic approach for planning effective, technology-rich lessons (Smaldino, 2019). By leveraging these models, educators can follow a step-by-step process to develop lessons that are both engaging and pedagogically sound in their use of technology.

The purpose of this paper is to create a lesson plan that effectively integrates technology at a higher level within the context of teaching quadratic functions in the IB Mathematics Applications and Interpretation course. A partner-based activity will be incorporated to enhance classroom engagement and foster student autonomy. In this activity, students will choose topics of personal interest, collect data, analyze a quadratic model, and interpret their findings within a real-world context. This approach aligns with higher levels of the Technology Integration Matrix, particularly in terms of promoting active, authentic, and collaborative learning, surpassing the level currently implemented in my classroom.

Current Level of Technology Integration

In the IB Mathematics Applications and Interpretations course, I currently use Google Slides daily to deliver lessons through the Smart Board and share these materials via Google Classroom for easy access on students' devices. This approach supports electronic notetaking and provides a consistent structure for instruction. However, students often remain passive learners during these lessons, as I primarily lead the instruction and provide real-world connections through my examples. Although students may choose between tools like Desmos or the TI-84 calculator, the learning experience is still largely teacher-directed rather than student-driven.

According to the Technology Integration Matrix (TIM), my instruction falls at the Adoption level for Active, Constructive, Authentic, and Goal-Directed Learning, and at the Entry level for Collaborative Learning. Students use technology in structured and guided ways, applying prior knowledge through tools like Desmos and solving real-world problems using calculators and graphing platforms. While students engage with meaningful content and reflect on their learning, these activities are mainly directed by the teacher.

Plan for Higher Technology Integration

After reviewing the current level of technology integration in my classroom while teaching quadratic functions, I identified specific characteristics that need to be strengthened to enhance student motivation and promote greater autonomy in the learning process. To address this, I plan to incorporate a partner activity that will allow students to explore quadratic functions through a topic of interest. Working in pairs, students will create a model and a presentation in which they will collect data, determine the quadratic model that best fits the data, identify all key characteristics of the model, and interpret their meaning within the context of the chosen topic. For this lesson, students are encouraged to select the form of technology of their choice.

Below is a description of the characteristics and the corresponding levels I aim to reach by incorporating this new activity into the lesson.

Active Learning – Adaptation Learner

At this level, students work independently with technology tools in conventional ways; the teacher acts as a facilitator toward learning and does not need to guide students step-by-step through activities (Florida Center for Instructional Technology, 2019b). At this stage, my plan is for students to work with a partner and apply quadratic functions to a topic of interest. They will use the technology of their choice to determine the features of the quadratic functions and explain what they represent in the context. It is essential to note that I will guide them through this process. However, they will have complete autonomy in deciding both the topic and the technology used to develop exploration.

Authentic Learning – Adaptation Level

At this level, students choose and explore a topic of personal interest, allowing them to take ownership of their learning. They begin to use technology independently in meaningful ways, and teachers design instruction that intentionally integrates technology tools to support learning beyond the classroom setting (Florida Center for Instructional Technology, 2019e). As mentioned earlier, in this lesson, students will select a real-world situation of their choice that can be modeled using a quadratic function. This not only promotes relevance and engagement but also helps students see the practical applications of mathematics in everyday life.

Through this activity, students will have the opportunity to connect a mathematical concept to a topic they are passionate about and share their findings with their peers through a Google Slides presentation of their choice. In addition, students will reflect on the entire process, what they discovered, how they applied quadratic functions to real-world data, and how technology supported their exploration.

ASSURE Lesson Plan

Lesson Title: Modeling Real-World Problems with Quadratic Functions

Lesson Length: 80 minutes

Analyze Learners

General Characteristics

The learning environment consists of 11th-grade students enrolled in the IB Mathematics Applications and Interpretations course at GP Upper School. The students are typically between 16 and 17 years old. These students engage with a mathematics curriculum that emphasizes conceptual understanding and real-world application, which can sometimes present challenges. However, as noted by Zenging et al. (2012), such challenges can be addressed through the thoughtful implementation of specific technologies in the classroom.

Entry Competencies

- Students in the course pass through a recommendation process where teachers from the previous year recommend them. Some students enrolled come from Geometry, and others come from Algebra 2. Those from Algebra 2 have already seen the concept of quadratic functions. However, those from Geometry are required to attend a readiness course where they learned all the fundamental concepts covered in Algebra 2 that are prerequisites for the IB Math Applications and Interpretations. Therefore, students already understand the concept of quadratic equations.

- The school is a Bring Your Own Device (BYOD) school. Since it is an independent school, having students with no electronic devices is not an issue. If the student does not bring an electronic device, the school provides one.
- All students are familiar with the use of electronic presentations such as PowerPoint, Google Slides, and Canvas.

Learning Differences and Needs

Students are more engaged when technology is used. It has also been identified that students are more involved in the learning process when they take ownership of their learning and work collaboratively with others. The majority of students have not been identified with learning disabilities. However, those who present them, the only required learning accommodation is 50% extended time.

Standards and Objectives

ISTE 6.C: Students communicate complex ideas clearly and effectively by creating or using a variety of digital tools such as visualizations, models or simulations.

- **Objective:** Students will communicate the quadratic model that describes a chosen real-world situation through oral presentations, using digital tools such as Google Slides, PowerPoint, or Canvas.

ISTE 4.A: Students select and use digital tools to plan and manage a design process that considers designs constratints and calculated risks.

- **Objective:** Students will work in pairs to create a quadratic model that best represents a real-world situation of their choice by using digital tools (e.g., Desmos, spreadsheets, or the TI-84 graphing calculator).

Select Strategies and Resources

Strategies

The selected strategies for this lesson include both teacher-centered and student-centered approaches. The teacher-centered strategies involve reviewing prior knowledge of quadratic functions, having students complete a brief Google Form for practice, and facilitating a whole-class discussion where selected students solve problems on the board and receive feedback from peers and the teacher. The student-centered strategies begin with a teacher-guided introduction to a mini exploration. Students then choose partners, select a real-world topic of interest, collect and analyze data using digital tools, and use their electronic devices to create and deliver presentations interpreting their quadratic model.

Select Resources

This lesson involves the continued use of Google Slides via the smartboard and accessing assignments through electronic devices. The lesson also requires the use of digital tools that enable students to find the quadratic model that best fits their data and create a presentation to share with the rest of the class.

Select Materials

A Google Sheet has been created for practicing quadratic functions, along with a corresponding Google Slides presentation that outlines the tasks students are expected to complete during their presentations. The grading criteria (Appendix B) have been adapted from those used in other presentations.

Utilize Technology, Media, and Materials

Preview Resources

- Technology: SMART board and TI-84 calculator
- Media: Google Slides, Google Form

Prepare the Environment

The lesson will take place in a regular classroom, where students are expected to bring their electronic devices. It is essential to contact the Instructional Technology department to explore ways they can support the lesson in the event of internet connectivity issues.

Prepare the Learners

To prepare students, I explain the upcoming lesson in advance, so they know what to expect. At the start of the lesson, I review the agenda and begin with a refresher on the relevant mathematical concept.

Provide the Learning Experience

I guide students by explaining what they are expected to complete by the end of the lesson and support them as they use technology to find the best-fitting quadratic model and prepare their presentations.

Learner Participation

Practice

At the beginning of the lesson, students are encouraged to come up to the board and share their answers from the Google Form. Those who remain seated stay engaged in the learning process by checking their own responses and providing feedback to their peers at the board. When working on their presentation, students should first agree on a topic of common interest to begin the assignment. They must also decide which technological tools they are both most comfortable using to identify the quadratic model and create the presentation.

Feedback

I provide feedback during student presentations not only to support the presenters but also to help the entire class learn from the comments and apply them to future presentations. All feedback is recorded on the grading criteria sheet (Appendix B), and final grades are shared with students during the next day's office hours.

Evaluation and Revision

Reflection of Learner Achievement and Technology Rating Scale

To evaluate student performance, I use the grading criteria outlined in Appendix B. The requirements are divided into five categories, with a total possible score of 20 points.

Evaluation of Strategies and Resources

I engage in informal conversations with students while they work to gain insight into their understanding of the content and their comfort with using digital tools during the activity. Additionally, students are asked to complete a Student Feedback Survey (Appendix C) at the end of the lesson to provide feedback on the activity. My own observations, along with the feedback from students, help me make adjustments and improve future lessons. It is important to note that not all lessons will be identical, as they must be adapted to meet the diverse characteristics and needs of the learners.

References

Kim, D., & Downey, S. (2016). Examining the Use of the ASSURE Model by K–12 Teachers. *Computers in the Schools*, 33(3), 153–168. https://doi.org/10.1080/07380569.2016.1203208

Florida Center for Instructional Technology. (2019). *Technology Integration Matrix*. University of South Florida. https://fcit.usf.edu/matrix/

Smaldino, S. E., Lowther, D. L., & Russell, J. D. (2019). *Instructional technology and media for learning* (12th ed.). Pearson

Zenging, Y,. Furkan, H., & Kutluca, T. (2011). The effect of dynamic mathematics software GeoGebra on student achievement in teaching of trigonometry. *Procedia Social and Behavioral Science 31*, 183-187. https:// doi:10.1016/j.sbspro.2011.12.03

Appendix A

The Technology Integration Matrix
Table of Summary Descriptors

The Technology Integration Matrix (TIM) provides a framework for describing and targeting the use of technology to enhance learning. The TIM incorporates five interdependent characteristics of meaningful learning environments: active, collaborative, constructive, authentic, and goal-directed. These characteristics are associated with five levels of technology integration: entry, adoption, adaptation, infusion, and transformation. Together, the five characteristics of meaningful learning environments and five levels of technology integration create a matrix of 25 cells, as illustrated below.

LEVELS OF TECHNOLOGY INTEGRATION → / CHARACTERISTICS OF THE LEARNING ENVIRONMENT ↓	ENTRY LEVEL The teacher begins to use technology tools to deliver curriculum content to students.	ADOPTION LEVEL The teacher directs students in the conventional and procedural use of technology tools.	ADAPTATION LEVEL The teacher facilitates the students' exploration and independent use of technology tools.	INFUSION LEVEL The teacher provides the learning context and the students choose the technology tools.	TRANSFORMATION LEVEL The teacher encourages the innovative use of technology tools to facilitate higher-order learning activities that may not be possible without the use of technology.
ACTIVE LEARNING Students are actively engaged in using technology as a tool rather than passively receiving information from the technology.	**Active Entry** Information passively received	**Active Adoption** Conventional, procedural use of tools	**Active Adaptation** Conventional independent use of tools; some student choice and exploration	**Active Infusion** Choice of tools and regular, self-directed use	**Active Transformation** Extensive and unconventional use of tools
COLLABORATIVE LEARNING Students use technology tools to collaborate with others rather than working individually at all times.	**Collaborative Entry** Individual student use of technology tools	**Collaborative Adoption** Collaborative use of tools in conventional ways	**Collaborative Adaptation** Collaborative use of tools; some student choice and exploration	**Collaborative Infusion** Choice of tools and regular use for collaboration	**Collaborative Transformation** Collaboration with peers, outside experts, and others in ways that may not be possible without technology
CONSTRUCTIVE LEARNING Students use technology tools to connect new information to their prior knowledge rather than to passively receive information.	**Constructive Entry** Information delivered to students	**Constructive Adoption** Guided, conventional use for building knowledge	**Constructive Adaptation** Independent use for building knowledge; some student choice and exploration	**Constructive Infusion** Choice and regular use for building knowledge	**Constructive Transformation** Extensive and unconventional use of technology tools to build knowledge
AUTHENTIC LEARNING Students use technology tools to link learning activities to the world beyond the instructional setting rather than working on decontextualized assignments.	**Authentic Entry** Technology use unrelated to the world outside of the instructional setting	**Authentic Adoption** Guided use in activities with some meaningful context	**Authentic Adaptation** Independent use in activities connected to students' lives; some student choice and exploration	**Authentic Infusion** Choice of tools and regular use in meaningful activities	**Authentic Transformation** Innovative use for higher-order learning activities connected to the world beyond the instructional setting
GOAL-DIRECTED LEARNING Students use technology tools to set goals, plan activities, monitor progress, and evaluate results rather than simply completing assignments without reflection.	**Goal-Directed Entry** Directions given; step-by-step task monitoring	**Goal-Directed Adoption** Conventional and procedural use of tools to plan or monitor	**Goal-Directed Adaptation** Purposeful use of tools to plan and monitor; some student choice and exploration	**Goal-Directed Infusion** Flexible and seamless use of tools to plan and monitor	**Goal-Directed Transformation** Extensive and higher-order use of tools to plan and monitor

The Technology Integration Matrix was developed by the Florida Center for Instructional Technology at the University of South Florida, College of Education. For more information, example videos, and related professional development resources, visit **http://mytechmatrix.org**. This page may be reproduced by schools and districts for professional development and pre-service instruction.

Appendix B

Mini Exploration Grading Criteria

	A: Presentation (4)	B: Mathematical Communication (4)	C: Personal engagement (3)	D: Reflection (3)	E: Use of mathematics (6)
	This criterion assesses the organization and coherence of the exploration. A well-organized exploration includes an introduction, has a rationale (which includes explaining why this topic was chosen), describes the aim of the exploration and has a conclusion. A coherent exploration is logically developed and easy to follow. *Graphs, tables and diagrams should accompany the work in the appropriate place and not be attached as appendices to the document.*	• use appropriate mathematical language (notation, symbols, terminology) • define key terms, where required • use multiple forms of mathematical representation, such as formulae, diagrams, tables, charts, graphs and models, where appropriate. *Students are expected to use mathematical language when communicating mathematical ideas, reasoning and findings.* *Students are encouraged to choose and use appropriate ICT tools such as graphic display calculators, screen shots, graphing, spreadsheets, databases, drawing and word-processing software, as appropriate, to enhance mathematical communication.*	This criterion assesses the extent to which the student engages with the exploration and makes it their own. Personal engagement may be recognized in different attributes and skills. These include thinking independently and/or creatively, addressing personal interest and presenting mathematical ideas in their own way.	This criterion assesses how the student reviews, analyses and evaluates the exploration. Although reflection may be seen in the conclusion to the exploration, it may also be found throughout the exploration.	This criterion assesses to what extent students use mathematics in the exploration. *Students are expected to produce work that is commensurate with the level of the course. The mathematics explored should either be part of the syllabus, or at a similar level or beyond. It should not be completely based on mathematics listed in the prior learning. If the level of mathematics is not commensurate with the level of the course, a maximum of two marks can be awarded for this criterion. The mathematics can be regarded as correct even if there are occasional minor errors as long as they do not detract from the flow of the mathematics or lead to an unreasonable outcome.*
0	The exploration **does not reach the standard** described by the descriptors below.	The exploration **does not reach the standard** described by the descriptors below.	The exploration **does not reach the standard** described by the descriptors below.	The exploration **does not reach the standard** described by the descriptors below.	The exploration **does not reach the standard** described by the descriptors below.
1	The exploration has **some coherence**.	The exploration contains **some relevant** mathematical communication, which is partially appropriate.	There is evidence of **limited** or **superficial** personal engagement.	There is evidence of **limited** or **superficial** reflection.	**Some relevant** mathematics is used.
2	The exploration has **some coherence** and shows **some organization**.	The exploration contains some **relevant appropriate** mathematical communication.	There is **evidence of significant** personal engagement	There is evidence of **meaningful** reflection.	**Some relevant** mathematics is used. **Limited understanding** is demonstrated.
3	The exploration is **coherent** and **well organized**.	The mathematical communication is **relevant, appropriate** and is **mostly consistent**.	There is abundant **evidence of oustanding** personal engagement.	There is **substantial** evidence of critical reflection.	**Relevant mathematics** commensurate with the level of the course is used. **Limited understanding** is demonstrated.
4	The exploration is **coherent**, **well organized**, **concise** and **complete**.	The mathematical communication is **relevant, appropriate and consistent throughout**.			**Relevant mathematics** commensurate with the level of the course is used. The mathematics explored is **partially correct**. **Some knowledge** and **understanding** are demonstrated.
5					**Relevant mathematics** commensurate with the level of the course is used. The mathematics explored is **mostly correct**. **Good knowledge** and **understanding** are demonstrated.
6					**Relevant mathematics** commensurate with the level of the course is used. The mathematics explored is **correct**. **Thorough knowledge** and **understanding** are demonstrated.

Appendix C

Feedback Student Form

Form description

How clear were the instructions for this activity?

Dropdown

1. Very clear
2. Mostly clear
3. Clear
4. Confusing
5. Very confusing
6. Add option

Required

How comfortable did you feel using the digital tools (e.g., Desmos, Google Sheets, TI-84, Google Slides)? *

1. Very comfortable
2. Comfortable
3. Neutral
4. A little Uncomfortable
5. Umconfortable

Did working with a partner help you better understand the concept? *

1. Yes, a lot
2. Yes, a little
3. Not really
4. Not at all

What digital tool(s) did you use to create your presentation? *

- Desmos
- Google Sheets
- TI-84 Calculatos
- Google Slides
- Power Point
- Canva
- Other

What part of the activity helped you learn the most?

Short answer text

What was the most challenging part of this activity? *

Short answer text

Appendix D

Peer Review Form

Type of Review	*LESSON PLAN*
Title of Lesson	Modeling Real-World Problems with Quadratic Functions
Designer/Author Name	Ana Paez
Peer Reviewer Name	Chirstopher Horne

Criteria	**Peer Review Comments**	**Designer/Author Revisions (why or why not)**
COVER PAGE INCLUDED 1. Introduction 2. Current Level of Technology Integration and Plan for increasing the level	1. Cover Page is included and formatted correctly; introduction outlines plan for lesson clearly and includes a note about a partner-based activity as well. 2. Plan is well-detailed, organized in an order that is clear and capable of being replicated by a peer.	1. Mentioning the partner activity in the introduction is important, as it is key to moving toward a higher level of technology integration. 2. The purpose of this paper is to provide a resource that any of my colleagues can use. Having a well-detailed plan is imperative so that others can understand and support the proposed changes in technology use.
3. Lesson Plan *(based on the ASSURE Model)* a. Analyze Learners: b. State (Standards if applicable) and Objectives:	3 a. A brief summary that summarizes well the population of students you are teaching in the	3. I revised the *Analyze Learners* section and included what students

c. Select Strategies (Select Media and Technology): d. Utilize Materials (Instructional Activities): e. Require Learner Participation (Practice & Feedback): f. Evaluation (Assessment of Learners) and Revision (Self Reflection for continuous improvement):	lesson. b. Supports the purpose of the lesson c. Each section is well-detailed and aligns with an ITSE standard. d. Outlined and easy to locate in the lesson plan e. Student participation in lessons, especially by allowing them to come to the front of the classroom is fun and interactive. f. I like that you share your feedback out loud so that the feedback can benefit others students.	are expected to do in the course. I felt it was important to mention this in the lesson plans so the reader can see how the instructional decisions align with course expectations.
4. References **5.** Appendices - *Peer Review Form (Reminder this completed by peer and author* - *Assessment Tool Chart*	4. Properly cited and using a hanging indent 5. Rubric for assignment is well-detailed and specific so student know who to maximize their points.	4. One reference was included because it was cited in the *Analyze Learners* section. 5. All needed Appendices are included, including the Peer Review Form.
Additional Comments	Peer Reviewer: While math is scary subject for me, personally, this lesson is interactive and allows students to work with others. I think this is a great idea for a lesson plan.	Designer: I understand how math can be intimidating for many people, which makes teaching the subject more challenging.

Explain below the steps you will take to self-reflect/evaluate how you taught the lesson (delivery of the lesson).

To evaluate how I delivered the lesson, I will reflect on how students interacted and how involved they were during the class. I will also review the feedback I provided during their presentations to ensure it was helpful and aligned with the lesson's goals. Most importantly, I will use the Student Feedback Survey to understand how students felt about the lesson and to find ways I can improve my teaching.