



CALIFORNIA STATE UNIVERSITY
MONTEREY BAY

Monterey Bay Aquarium Innovation Lab Vinyl Cutter “Level 1 Badge”
Course

CAPSTONE PROPOSAL

Submitted in partial satisfaction of requirements of the degree of

MASTER OF SCIENCE in

Instructional Science and Technology

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Capstone Approvals: (At least one advisor and capstone instructor should approve)

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Abstract

The efforts of this capstone are directed at creation of a safe and effective vinyl cutter “Level 1 Badge” course for the Monterey Bay Aquarium’s (MBA) Innovation Lab. Acquisition of a “Level 1 Badge” permits the learner to use the vinyl cutter with supervision. The Aquarium education team’s goal to create eLearning products for all Innovation Lab tools is supported by this project.

Learning objectives for this course aimed at 11- to 65-year-old Innovation Lab participants are both declarative and procedural. Successful course completion demonstrates the learner’s ability to use the vinyl cutter safely and effectively with supervision.

Behavioral and cognitivist learning theory tenets provide the foundation for much of this safety course’s structure, which is framed around the cognitivist instructional theory, Gagne’s Nine Events of Instruction. Stolovitch and Keeps’ (2011) *Five-Step Model for Structuring Training* informs the agenda.

The course aims to prepare Innovation Lab participants to engage with the vinyl cutter tool in a constructivist fashion, aligning with the Innovation Lab’s guiding philosophy of Liberatory Design. Tenets of constructivism are consciously integrated. Facilitating Liberatory Design and its incorporation into the course is an area of research for this capstone.

Visual and auditory online course design choices are guided by the multimedia principles of eLearning. The goals of facilitating generative and essential processing, while minimizing extraneous attention-diversion, inform course design decisions.

Course evaluation and capstone support are provided by the subject matter experts: Education Programs Director Katy Scott and Senior Education Specialist and Innovation Lab

Commented [AP1]: Currently the "Five-Step" Model is reflected in context of the "Agenda" breakdown. Gagne's Nine Events are addressed in the Learning Theories section.

I imagine it might be ideal to choose one or the other? Probably omit the Five-Step model in lieu of the Nine Events?

Commented [AP2]: Capitalize titles "Education Programs Director" and "Senior Education Specialist"?

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manager Luis David Calderon. Course pilot testing will be completed by Innovation Lab attendees in the summer of 2023.

Introduction

Background and Problem Statement

The Innovation Lab is a maker space within the Monterey Bay Aquarium's (MBA) Bechtel Family Center for Ocean Education and Leadership (Monterey Bay Aquarium, 2022a). Their projects grant young people the opportunity to engage in discovery learning, building a sense of their power to positively impact the world and combat climate change. The center additionally engages in outreach efforts that empower classroom teachers to confidently address climate education.

The Innovation Lab houses many tools including 3D printers, vinyl cutters, sewing machines, a laser cutter, hand tools, and a heat press. To use them with supervision, participants must obtain a "Level 1 Badge" by completing safe and effective use training. Prior to the COVID-19 pandemic, all training was completed in-person. Since the advent of the pandemic online instruction has been made for some tools, but the majority still require creation. Capstone efforts will focus on creation of the vinyl cutter "Level 1 Badge" course.

Target Audience and Context

The target audience is 11- to 65-year-old Innovation Lab participants. The lab consistently hosts school field trips, summer programs, and teacher trainings. The age range is wide, and participants come from a variety of backgrounds. Prior knowledge of tools will not be assumed. Training materials will aim to meet the needs of novices and will instruct to the lowest level of understanding.

Rationale for the Project

The Monterey Bay Aquarium's Innovation Lab officially opened its doors in 2019. Shortly thereafter, the COVID-19 pandemic necessitated a rapid shift to online learning in 2020. Rising to the challenge, the education team identified the learning management system Thinkific to house online trainings and set about creating necessary materials. Some tools, such as the 3D printer, now have eLearning trainings available. Others, like the vinyl cutter, have only very basic instruction.

While all trainings were initially synchronous, the Innovation Lab's education team wishes to capitalize on technology's capacity to deliver the initial portions of tool training either synchronously or asynchronously online. As Stolovitch and Keeps (2011) assert, this will allow more people in more places to access the training in whatever timeframe works for them, and however often they feel is necessary. It is anticipated that in-person, synchronous completion of this online coursework will comprise most trainings in the immediate future. This will facilitate provision of the support novice learners may require. Virtual coursework will maximize in-person efficiency, significantly cutting down on time and personnel resource utilization in the Innovation Lab.

The skeleton of basic instruction exists for the vinyl cutter in the form of two Google Docs and a Google Forms seven-question assessment quiz. One Google Doc is a simple introduction that includes images, text, and a link to the GS-24 vinyl cutter user's manual (Roland DG Corporation, 2015). The other is a procedural checklist for final vinyl cutter skill demonstration. These existing materials will be used as reference and relevant elements will be integrated into the final deliverable.

Statement of the Learning Objectives

Identification of objectives is an essential initial step when building instruction, providing a reference map, and streamlining efforts. The goal of this training is to prepare Innovation Lab participants to use the vinyl cutter safely and effectively with supervision.

Declarative objectives for this course include:

- 1) Given a job aid, Innovation Lab participants will be able to state the purposes of the GS-24 vinyl cutter major parts with 100% accuracy.
- 2) Given a job aid, Innovation Lab participants will be able to identify the main purposes for which the GS-24 vinyl cutter can be used with 100% accuracy.
- 3) Given access to a job aid, Innovation Lab participants will be able to identify appropriate materials to use with the vinyl cutter with 100% accuracy.
- 4) From memory, Innovation Lab participants will be able to accurately identify basic safety guidelines with 100% accuracy on presented test questions.

Procedural objectives for this course include:

- 1) Given access to a job aid, Innovation Lab participants will be able to import sample data into CutStudio software without receiving an “error” notification.
- 2) Given a reference sheet, Innovation Lab participants will be able to load A4-size material into the correct position in the vinyl cutter based on the material’s width with 100% accuracy.
- 3) Given access to Thinkific vinyl cutter course instructions, Innovation Lab participants will be able to import one of several pre-selected vector designs into Adobe Illustrator that is compatible with the GS-24 vinyl cutter.

- 4) From memory, Innovation Lab participants will be able to turn the vinyl cutter on and off.
- 5) With access to a performance guide, Innovation Lab participants will be able to direct the GS-24 vinyl cutter to cut a design.
- 6) With access to a performance guide, Innovation Lab participants will be able to resize a vector design in CutStudio. This vector design will be compatible with the GS-24 vinyl cutter.
- 7) Given access to a performance guide and the GS-24 vinyl cutter user's manual, Innovation Lab participants will be able to identify the steps to address a common troubleshooting scenario. This scenario will be identified with the aid of SME support.

Research Question

Commented [st4]:

Liberatory Design and Design Thinking

The Innovation Lab is built upon the philosophical tenets of Liberatory Design. As the Aquarium's team states, "we've integrated maker education with environmental education in an equity-centered process" (Monterey Bay Aquarium, 2022b).

Liberatory Design philosophy was inspired by Stanford University d.school's design thinking (DT). Developed in the early 1940s and 1950s by John E. Arnold within the Stanford Joint Program in Design, DT gained popularity in the mid-2000s (Auernhammer & Roth, 2021). Flexible and human-centered, it aims to support practitioners in creatively building concrete, empathetic solutions.

The novel approach of Liberatory Design combines DT with deep empathy and complex design theory. Its first prototypes were presented in 2017 with the stated goal of flexibly tackling complex challenges with equity (Robalewski, 2021; National Equity Project, n.d.). Six nonlinear,

iterative stages comprise its design: empathize, define, inquire, imagine, prototype, and try. Its overarching framework asks its practitioners to see the problem, engage with stakeholders to create meaning, and take actions from which they intend to learn (National Equity Project, n.d.).

The vinyl cutter “Level 1 Badge” course supports the Innovation Lab’s goals to facilitate Liberatory Design thinking in its participants. While much of the safety coursework will be delivered in alignment with behaviorist and cognitivist tenets by virtue of the objectivist nature of content, the coursework design will aim to inspire equitable problem-solving. Attaining the vinyl cutter “Level 1 Badge” via course completion sets the groundwork for Liberatory Design problem-solving to commence. This will be communicated within the course to students.

While the primary goal of this course is to facilitate efficient and effective understanding of all components that support GS-24 vinyl cutter design and cutting, creative incorporation of the tenets of Liberatory Design philosophy into the training is an area of research and interest for this capstone.

Review of Relevant Literature/Design Thinking Application

As the Monterey Bay Aquarium’s Education Programs Director Katy Scott asserts, the Innovation Lab supports participants in building not only physical solutions, but “their own identities as people who can make change in the world” (MBA, 2022b). The adoption of Liberatory Design as the Lab’s leading framework merges “equity and STEM together in a single framework that includes a process for defining and solving complex problems – as well as mindsets” (MBA, 2022b).

Examples of successful Design Thinking application, the inspiration for Liberatory Design, present compelling evidence for its implementation. Ignite, a Duke undergraduate program created to address the 2015 Sustainable Development Goals, required students to work

within a community's cultural and geopolitical position to create night light access solutions (Mueller et al., 2020). Altman et al. (2018) conducted a systematic literature review that identified examples of DT implementation in medicine; evaluation of 19 successful studies, 11 with mixed results, and one that was unsuccessful revealed that successful DT can result in both simple physical and technology-intensive interventions in healthcare. Design school students in Indonesia utilized the DT model to facilitate creation of a characteristic woven pattern for the village of Troso and called on DT tenets to support the identification of alternative uses for unused jeans materials, demonstrating the versatile applications of this philosophy (Caroline et al., 2021; Fajarwati et al., 2021).

Proposed Applications of Design Thinking

Researchers in multiple domains recognize the potential for Design Thinking to benefit their fields. Earle et al. (2021) proposes that the iterative cycling DT process might be implemented in virtual reality scenarios to prepare business students for the challenge of addressing sustainability. As the field of classical mechanics transitions to mechatronic and cyber-physical systems, Tekaat et al. (2021), asserts that the user-centered DT structure – supported by the growth of model-based systems engineering – can support empathetic, creative problem-solving. Moganakrishnann et al. (2018) also advocates for DT – within the framework of Liberatory Design practice – to support sustainable development engineering, arguing that an empathetic stance facilitates critical questioning of assumed power structures. Rois et al. (2020) proposes that the waste management system in the city of Depok might benefit from application of the five-stage DT approach. The areas in which DT could prove effective are many and varied.

Implications, Future Research, and Relevance to Capstone

Future research is required to explore the sustainability of DT and Liberatory Design frameworks in the various companies, schools, and entities that seek to conscientiously implement it. To support its continued use, further randomized, controlled studies ought to quantitatively demonstrate its utility.

This capstone project's safe and effective vinyl cutter "Level 1 Badge" course aims to prepare its students to engage with this Innovation Lab tool with a mindset primed to address complex problems with empathy. While wholesale evaluation of the efficacy of Liberatory Design's framework exceeds the limits of this straightforward design, effectiveness of Liberatory Design integration into this capstone course might be evaluated via multiple avenues. Input from the Aquarium's STEM Integration Manager Athena Barrios, the Education Programs Director Katy Scott, and the MBA's Senior Education Specialist Luis David Calderon will be elicited to assess its incorporation. Participant feedback will be collected upon completion of the course. Broader evaluation of the effectiveness of conveying Liberatory Design principles in the Innovation Lab might be gathered in the months and years that follow the completion of the vinyl cutter and other tools' courses.

In a March 2023 SME meeting, Education Programs Director Katy Scott communicated that the STEM Integration Manager Athena Barrios intends to create a course on Liberatory Design this summer. Communication has been sent to Athena, expressing an interest in her work, and requesting to receive her input on how this course might best reflect and inspire Liberatory Design.

Solution Description/Media and Delivery System Decisions

Delivery Format(s)

Most of this instructional course's content falls into the category of directive training (Stolovitch & Keeps, 2011). Clear performance objectives are matched with test items, and learners are guided to engage in meaningful activities "as they progress along predetermined paths" (Stolovitch & Keeps, 2011, p. 122 – 125). As a major component of this training is safety assurance, learner self-direction is curtailed at this stage. Successfully attaining a "Level 1 Badge" sets learners up to later engage in guided discovery learning, implementing the skills they gain in this course to tackle self-identified challenges.

The Monterey Bay Aquarium utilizes the learning management system (LMS) Thinkific. This LMS's standalone course-building space integrates well with multiple software and offers 24/7 support (Raounda, 2022). Multiple media formats can be integrated, navigation is straightforward, and visual design is unobtrusive.

A course on MBA Thinkific course creation is currently housed in the Aquarium's Thinkific library. It includes instruction on how to incorporate products made with Adobe Spark, Nearpod, Jamboard, Screencastify, Flipgrid, Educreations, Google Earth, Kahoot!, and iMovie. The intention is to create most of the capstone course with Articulate 360 Storyline software. This plan has been confirmed with the SMEs. It is possible that the aforementioned tools may also be integrated. Identified eLearning authoring software tools will be utilized to create fourteen online modules on safe and effective vinyl cutter use.

Based upon student hardware and software access, the first modules may be completed either asynchronously at home or synchronously in the Innovation Lab. Final hands-on instruction, assessment of procedural understanding, and ultimate "Level 1 Badge" sign-off will take place synchronously in the Innovation Lab under certified personnel supervision. The goal

of this blended approach is to maximize students' ability to access and retain information, while also providing the essential concrete experiences that culminate in learning transfer.

Media

Media will include video instruction, physical and online job aids, picture references, direct software interaction accompanied by audio and textual instruction, and in-person training and sign-off. Carefully scripted audiovisual instruction will provide step-by-step guidance within the context of example projects, as most of the work is procedural. Video instruction will be made easily accessible for reference after the "Level 1 Badge" is obtained. Job aid references with static images and text will also be created and made readily available for online and physical in-person access. These job aids will incorporate carefully selected visuals that include only relevant information. As Clark and Mayer (2018) advise, "especially for novice learners, removing non-essential details from visual representations may be advisable" (p. 263). Authentic activities with software design and the vinyl cutter machine will optimize transfer.

Subject matter expert Katy Scott has communicated that professional videography tools, filming personnel, and talent are available through the Aquarium. The videos already in place for the 3D printer are simple, but effective. These video templates, existing training, and feedback from the MBA team will provide guidance for optimization of scripting and production of instructional videos. Initial Innovation Lab vinyl cutter course filming was completed on the 14th, 16th, 18th, and 20th of April 2023, culminating in production of three videos: "Vinyl Cutter Parts and Their Purposes," "Materials You Can Use with the Vinyl Cutter," and "Vinyl Cutter Safety." Storyboards were reviewed, modified, and approved by SMEs prior to filming. Edited videos will be presented to SMEs in the coming weeks for further feedback and final approval.

This capstone training culminates in authentic experiences. Hands-on interaction with the software tools Adobe Illustrator and CutStudio will be facilitated. The final training and sign-off will take place with the vinyl cutter in the Innovation Lab.

Instructional Strategies and Activities

Agenda Explanation

The agenda of this course is informed by an intention to maintain triangulated alignment among objectives, learning activities, and assessments. Iterative analyses within “an intentional learning environment” (Dempsey & Van Eck, 2018, p. 230) will support alignment.

Recognizing the limits of short-term memory, information will be presented in small chunks with frequent engagement check-ins (Stolovitch & Keeps, 2011). It is understood that, without preexisting knowledge, about four chunks of information can be held in short-term memory. If this data goes untreated, it disappears within 10-15 seconds (Stolovitch & Keeps, 2011). Recognizing this, the behavioral concept of programmed learning will be incorporated – small steps will be followed by simple testing before students move on to the next item. Confirming or corrective feedback will be provided after each miniature assessment. The opportunity to retry will be offered after each question. This will be done to increase engagement and motivation through success (Bonaiuti, 2011). The timing of course completion will be student-directed, allowing for pause and review of previous materials. Students will be empowered to curate their own learning experience.

The mantra Stolovitch and Keeps (2011) recommend guides the design of this course: it will be “learner-centered” and “performance-based.” Learner performance will be elicited through frequent quizzes, software design, and hands-on vinyl cutter use.

Agenda

1. Introduction (4 min): Present example projects and introduce Liberatory Design
2. Course Objectives (3 min): Inform students of the course goals and what they will be able to do and understand after completing the course
3. Vinyl Cutter Uses (3 min): Introduce students to general vinyl cutter uses and types of products that can be made with the vinyl cutter
4. Vinyl Cutter Parts and Their Purposes (8 min): Educate students on each of the individual vinyl cutter parts and the purposes of those parts
5. Materials You Can Use with the Vinyl Cutter (6 min): Educate students on what materials are appropriate to use with the vinyl cutter
6. Vinyl Cutter Safety (6 min): Educate students on important vinyl cutter safety protocols
7. Vector Files and the Vinyl Cutter (4 min): Introduce students to the concept of a vector file and provide education on why this type of file is needed to make vinyl cutter products
8. Choose a Vector File (4 min): Provide students with a curated folder of Aquarium style vector files and guide them through selection of a file
9. Design Transfer (4 min): Introduce students to CutStudio and walk them through the steps of transferring a design
10. Resize a Design (3 min): Educate students on how to use the vinyl cutter to resize a design with the aid of a pre-cutting preparatory steps checklist
11. Basic Vinyl Cutter Use (8 min): Educate students via demonstration how to perform basic vinyl cutter functions
12. Sticker Transfer (3 min): Educate students via demonstration how to transfer a sticker
13. Frequently asked questions (FAQs) and Troubleshooting Tips (8 min)
 - a) Adobe Illustrator FAQs

b) Roland CutStudio FAQs

c) GS24 vinyl cutter FAQs

14. Final Sign-off (24 min): Innovation Lab hands-on demonstration and sign-off with supervision

15. Resources (3 min): Learning points summary, links to resources introduced in the course, access to further learning resources (e.g., MBA Adobe Illustrator course)

Teaching/Learning Activities

Introduction (4 min): Present example projects and introduce Liberatory Design

The introductory module addresses the first step of the *Five-Step Model for Structuring Training* that Stolovitch and Keeps (2011) prescribe: *rationale*.

Learner attention will be gained via the presentation of example projects in video format. These examples will communicate the purposes for which the vinyl cutter may be used and serve as inspiration. A brief introduction to Liberatory Design philosophy within the context of vinyl cutter product creation will be included. A closing slide will reiterate vinyl cutter uses and Liberatory Design philosophy tenets within the context of the presented examples, allowing for critical information review. A two-question check-in quiz will evaluate the learner's understanding of vinyl cutter uses and of Liberatory Design and facilitate engagement.

Course Objectives (3 min): Inform students of the course goals and what they will be able to do and understand after completing the course

The second of the five steps Stolovitch and Keeps (2011) prescribe is *objectives*. Clear objectives provision to learners is known to be beneficial. According to Stolovitch and Keeps (2011), research “demonstrates the value of clarifying to the learners what it is they will be able to do at the end of the...course...The clearer...it is for the learners, the higher the probability

Commented [AP5]: Possible proposed modification:
 - Module 1: Example projects and Liberatory Design (if Liberatory Design to be included in course)
 - Module 2: Course objectives
 - Module 3: Vinyl cutter uses

Explanation of changes:
 - Module 1 will "gain attention" and provide overarching context
 - Module 2 will tell learners what to focus on learning before diving into the uses, etc.
 - Module 3 will begin going over what Module 2 let the learner know to expect

they will learn it” (pp. 72 - 79). Having established the rationale for this training, the objectives of the course will be provided in a video, followed by a summary slide. Video will convey information in a memorable fashion, while the slide will reiterate important data and provide a resource for review. The Innovation Lab participants, upon completion of this course, will be able to design and cut vinyl cutter products with supervision and access to job aids.

The audience’s age ranges from 11-year-old to 65-year-old learners. It is important to instruct to the lowest level of understanding. Encouragement, alongside clear guidelines, will aim to speak to audience members from novice to expert. The training will clearly state that, regardless of experience level, successful completion of training is required to use tools within the Innovation Lab.

Vinyl Cutter Uses (3 min): Introduce students to vinyl cutter uses and types of products that can be made with the vinyl cutter

Depending upon the content of other modules this one may be excluded. This possibility has been discussed with SMEs and final determination will be made with SME input. If the initial module’s presentation of example projects and the explanation of products within the context of the appropriate materials module are determined insufficient, this module will concisely list vinyl cutter uses in video and slide format. Two to three understanding check-in questions will follow content presentation to elicit learner engagement.

Vinyl Cutter Parts and Their Purposes (8 min): Educate students on each of the individual vinyl cutter parts and the purposes of those parts

A video will introduce the learner to the parts of the vinyl cutter. The purposes of those parts will be explained. The video will be followed by labeled vinyl cutter parts visual aid slides for the front of the vinyl cutter, the side of the vinyl cutter, and the operation panel. A job aid

version of this slide will be made available online in the final section of the module. A physical job aid will also be available in-person in the Innovation Lab directly beside the vinyl cutter.

A note may be included that, if the participant is completing this online training in the Innovation Lab, they are encouraged to ask a supervisor with the appropriate badge level to introduce them to the vinyl cutter before proceeding.

This section will conclude with a drag-and-drop understanding check-in of the vinyl cutter parts, eliciting further active participation and review.

Steps four and five of Stolovitch and Keeps' (2011) *Five-Step Model for Structuring Training* are *evaluation* and *feedback*. All instructional modules will include check-in evaluation quizzes like this drag-and-drop quiz to verify if understanding has been achieved and to identify gaps that require support. Confirming or corrective feedback will immediately follow evaluations, followed by encouragement to attempt again if appropriate. Within the course, these evaluation and feedback opportunities may be labeled “learning check-ins” or “practice exercises” rather than “quizzes” or “tests” to mitigate the fear response the latter terms can elicit (Stolovitch & Keeps, 2011).

Materials You Can Use with the Vinyl Cutter (6 min): Educate students on what materials are appropriate to use with the vinyl cutter

A video will present materials that may appropriately be used with the vinyl cutter. A review slide will list the materials introduced in the video. A job aid version will be linked in the final section of the module. A physical reference will also be available in-person in the Innovation Lab directly beside the vinyl cutter.

A two- to three-question multiple choice quiz will follow the video. Confirming or correcting feedback will follow quiz completion with the opportunity to retake the quiz if

needed. Feedback to one of the quiz questions might include an example of the negative results of using a non-recommended material, maximizing meaningfulness for the learner.

Vinyl Cutter Safety (6 min): Educate students on important vinyl cutter safety protocols

A video will provide education on the importance of adhering to vinyl cutter safety protocols and will list the most important safety “Do’s” and “Don’ts.” A final review slide will reiterate safety information. This will be made available as a job aid.

The seven-question prerequisite safety quiz that follows this section must be completed with 100% accuracy before the participant is permitted to proceed. This quiz will include a mixture of multiple choice, “drag and drop,” and short answer questions. Confirming or corrective feedback will be provided after quiz completion. The quiz may be reattempted an unlimited number of times until 100% accuracy is achieved.

Examples of successful and unsuccessful adherence to safety standards may be provided to elucidate the importance of provided directions. For example, it may be reasonable to incorporate a non-example of a broken device or a failure to maintain safety standards that resulted from improper use of the vinyl cutter, bolstering motivation to complete safety training. The advisability of non-example inclusion will be discussed with SMEs.

Vector Files and the Vinyl Cutter (4 min): Introduce students to the concept of a vector file and provide education on why this type of file is needed to make vinyl cutter products

Learners will be provided explanatory information in video format of how a vinyl cutter works. This will include an explanation of what vector files are and why they are compatible with the vinyl cutter. The activities to follow will be informed by the understanding this section provides.

Choose a Vector File (4 min): Provide students with a curated folder of Aquarium style vector files and guide them through selection of a file

The adult learning principles of *experience* and *autonomy* are consciously incorporated in this module (Stolovitch & Keeps, 2011). Specific supportive guidance will be provided, but if participants have prerequisite experience, they will be encouraged to create designs as complicated as their skill level permits. All learners, regardless of experience, will be provided with multiple vector file options to choose from, incorporating a degree of autonomy. These sample vector files will be obtained from a site with royalty-free stock media, such as Pixaby.com. A screencast video educating learners on how to find a desired vector graphic on Pixaby.com may also be included.

This activity also successfully integrates the adult learning principle of *action*. The admonition of Stolovitch and Keeps (2011) to “Above all, keep...training active” (p. 126) is honored. The majority of subsequent modules also require active engagement from participants.

The prior *experience* of learners will be acknowledged in noting that learners may alternatively use CorelDraw or InkScape if they are familiar with these software tools. If learners have home access to software, they may choose to use them.

Design Transfer (4 min): Introduce students to CutStudio and walk them through the steps of transferring a design

The third step in the Stolovitch and Keeps’ (2011) *Five-Step Model for Structuring Training* is *activities*. Hands-on procedural engagement with software is required as learners follow simple step-by-step guidance to transfer their selected vector file from Adobe Illustrator, CorelDraw, or InkScape to CutStudio.

Commented [AP6]: Remove references to adult learning principles? Or include explanation as to their inclusion in course design in intro to this section?

Resize a Design (3 min): Educate students on how to use the vinyl cutter to resize a design with the aid of a pre-cutting preparatory steps checklist

Continued hands-on engagement with CutStudio will be facilitated in this activity module. In a March 2023 meeting, subject matter expert and Innovation Lab manager Luis David Calderon communicated the importance of this module's inclusion to facilitate conscientious preservation of materials. Encouragement to use resources wisely and prevent waste is incorporated throughout the course. This training section will guide learners to resize designs, making use of materials that might otherwise be discarded.

Basic Vinyl Cutter Use (8 min): Educate students via demonstration how to perform basic vinyl cutter operations (Loading the material, turning the machine on, setting the origin, removing the vinyl background, and shutting down the machine)

A carefully scripted and shot video will demonstrate the steps of vinyl cutter operation. Three quiz questions may be integrated into the video for engagement. Confirming or corrective feedback and the opportunity to retry will accompany all questions.

A job aid that describes the demonstrated steps will be included in a slide that follows the video. A link to this job aid will be included in the final "Resources" module. A physical job aid will also be made available in-person in the Innovation Lab directly beside the vinyl cutter.

A four- to five- question multiple choice quiz will follow the video. Confirming or correcting feedback will follow quiz completion with the opportunity to retake the quiz.

Sticker Transfer (3 min): Educate students via demonstration how to transfer a sticker

At a capstone planning meeting in March 2023, subject matter experts Katy Scott and Luis David Calderon recommended division of the vinyl cutter use demonstration videos into

“basic steps” and “sticker transfer” modules. This information chunking will be done to facilitate generative processing while preventing cognitive overload.

Frequently asked questions (FAQs) and Troubleshooting Tips (8 min): Adobe Illustrator FAQs, Roland CutStudio FAQs, and GS24 vinyl cutter FAQs

Short videos will provide simple troubleshooting tips and techniques for Adobe Illustrator, CutStudio, and the GS-24 vinyl cutter machine. Quiz questions may be incorporated into the videos. Answers will be met with confirming or corrective feedback and the option to retry until success is achieved.

“Frequently asked questions” (FAQs) will be reviewed in these videos and will be summarized in slide format. These FAQs will be made available as job aids, included in the final “Resources” module. Instructions to reference the manual with an included GS-24 manual link (Roland DG Corporation, 2015) will be included.

The module will include a basic troubleshooting challenge scenario. The learner will be provided a worked example with step-by-step guidance on how to find steps to address a problem that arises. SME input will be elicited to determine an ideal common troubleshooting scenario.

Final Sign-off (24 min): Innovation Lab hands-on demonstration and sign-off with supervision

The third step of Stolovitch and Keeps’ (2011) *Five-Step Model for Structuring Training* is *activities*. They assert that learning in authentic environments maximizes transfer. In this final sign-off learning activity, participants will complete hands-on training and sign off with the Innovation Lab vinyl cutter, accompanied by certified supervisory personnel.

Supervisory sign-off personnel will meet learners where they are, review hands-on use instructions, and provide scaffolded support. As Hoadley and Van Haneghan (2018) state,

scaffolding can take many forms, including “activity structures [and] larger social structures that support learning” (p. 73). Guidance on vinyl cutter use will be provided by the supervisor with the support of a structured performance checklist to assess if the learner has met objectives. Existing instructional materials include a performance checklist for final sign-off. This form will be reviewed and optimized for use with SME support.

Resources (3 min): Learning points summary, links to resources introduced in the course, access to further learning resources (e.g., MBA Adobe Illustrator course)

A final summary module will succinctly list the content covered in the course. It will provide links to course videos, job aids, and the GS-24 vinyl cutter user’s manual (Roland DG Corporation, 2015).

Instructions on how to access guidance in the Innovation Lab via personnel, online guides, and physical job aids will be provided.

A brief introduction to the succeeding badge levels and how to obtain them will be provided, encouraging further engagement if the participant is motivated and interested.

The Innovation Lab’s education team intends to create a full course on Adobe Illustrator use. Once the Adobe Illustrator course is complete, a link will be added to this final “Resources” module, providing interested participants with the opportunity for further engagement.

Congratulations will be provided for successful completion of this course. Learners will be encouraged to return to these materials as often as needed for review and support. Pending feedback from SMEs, it might be reasonable to incorporate links to example projects, the MBA Instagram’s repository of completed projects, and a challenge to the learner to incorporate Liberatory Design principles in creative projects they are now prepared to take on.

Learning Theories

As Harasim (2017) asserts, the learning theories of behaviorism, cognitivism, and constructivism work in conjunction, and “ought not to be considered as distinct silos” (p. 10). If applied appropriately, their tenets complement one another in practice. The work of this capstone project is informed, in part, by all three of these theories.

The objectivist theories of behaviorism and cognitivism provide the foundation for the safety and effective use elements of this capstone project. The tenets of constructivism are integrated as relevant into the course design, keeping in mind that the end goal of the course is to prepare students to engage with the vinyl cutter in a constructivist fashion that aligns with the design philosophy of Liberatory Design.

Behaviorism

From a behaviorist perspective, optimal presentation of a stimulus results in a predictable response. Performance standards are explicit, and learners are notified of success or failure (Deubel, 2003). To comply with safety standards, much of this course is built around this learning theory: learners are expected to act in accordance with stimulus results, repeating the behaviors that bring success and avoiding those that do not produce the desired outcome.

When high cognitive processing and creativity are demanded, behaviorism’s failings are stark, but as Keramida (2015) argues, this theory’s application is pertinent when desired outcomes are precise and measurable. As this capstone project is concerned with maintaining learner safety when handling tools, behaviorist learning tenets are foundational and relevant. Knowledge acquisition will be facilitated in the forms of discrimination of machine components and the association of linking desired behavior with positive outcomes (Keramida, 2015). Applicable understanding and appropriate actions will be reinforced, while unsafe choices will be explicitly discouraged. Behaviorism on its own is insufficient; the relevance of learners’

mental operations and personal backgrounds is unassailable, but this learning theory provides a solid foundation for much of the work of this capstone project.

Cognitivism

The learning theory of cognitivism recognizes the complex processing that takes place between the presentation of a stimulus and the resulting response. Schemata – organized, dynamic memory structures – facilitate efficient navigation of the world. As new information is presented these schemata accommodate modification (Harasim, 2017). Active engagement with authentic tasks encourages this mental process of merging novel information with prior understanding (Deubel, 2003). Learners are encouraged to discover concepts via questioning and evaluation as a coach skillfully scaffolds new information and encourages cooperative learning (Deubel, 2003). This capstone’s work is informed by an acknowledgement of the complex mental processes that learners undergo between stimulus and response and incorporates tenets that a cognitivist framework espouses, facilitating schema modification via scaffolded support.

As a safety course, the framework is necessarily structured around knowledge transmission from teacher to student in an objectivist, didactic model. Both behaviorist and cognitivist tenets call for the instructor to direct attention, elicit active engagement from the learner, and facilitate feedback within authentic and meaningful experiences (Deubel, 2003). Leaning heavily on these objectivist learning tools, the design of this capstone embraces the mental processing cognitivism acknowledges.

Social Learning Theory

Albert Bandura’s social learning theory holds that people can learn through observation. Correct modeling of tool operation in the Innovation Lab via video and in-person demonstration aims to facilitate learning in this capstone project. As stated by Bandura – who categorized his

social learning theory as cognitivist – learning would be not merely arduous, but also dangerous, if physical action were always necessary for acquisition of new information (Cherry, 2022). Visual models of how to safely conduct oneself around the potentially dangerous cutting tool will be provided to learners. Physical supervisory models (teachers) will be present in the Innovation Lab to demonstrate safe behavior.

The vicarious experience of witnessing correct behavior, which can alone instill belief in the learner that they too are capable, will be followed by “mastery experiences.” Students will assume authentic physical challenges through which they will confirm their competence (Lopez-Garrido, 2023). Social persuasion via positive verbal feedback and encouragement from trainers will further support development of student self-efficacy.

Gagne’s Nine Events of Instruction

Influential American psychologist Robert Gagne introduced the Nine Events of Instruction, an instructional theory based on cognitivist learning theory tents. These nine events inform the framework of this capstone’s instructional design.

- 1) **Gain attention:** For eLearning, LaMotte (n.d.) recommends introducing content with an attention-grabbing short video, a question that primes the learner, or a relatable story. The introductory module for this course will provide inspirational example products created with the vinyl cutter in the context of a consciously scripted and well-shot video.
- 2) **Inform students of the objectives:** The second module will present students with clearly stated declarative and procedural objectives. LaMotte (n.d.) recommends increasing engagement by framing objectives as questions or challenges. This recommendation will be considered with the goal of optimizing intrinsic motivation.

- 3) **Stimulate recall of prior learning:** This event guides the learner to create connections, integrating new information with what is already known. To accomplish this, the course might ask learners to think of other creation projects they have taken on (e.g., drawing a picture, writing a letter, building a sandcastle, etc.). Their understanding of the importance of basic safety protocols might be touched on via examples with which they are already familiar (e.g., avoiding touching a hot stove, wearing your seat belt).
- 4) **Present the stimulus:** The “stimulus” makes up the bulk of the course. In this case, modules 4 – 13 provide directions within the context of examples, videos, slides, demonstrations, and hands-on learning activities. As LaMotte (n.d.) advises, multiple formats are utilized to optimize content provision and learner engagement.
- 5) **Provide learning guidance:** Much of the curriculum will be presented within the context of examples. As Clark and Mayer (2016) relate, studies across disciplines demonstrate the effectiveness of worked examples, or step-by-step guidance, especially when the material is novel and when explanations are provided. Review slides and job aids will guide and support learners. In-person Innovation Lab supervisors will support the hands-on sections (and eLearning module navigation if needed). As learners communicate their current knowledge level, education personnel in the Lab will be able to tailor their scaffolding approach appropriately, introducing an element of constructivism (discussed in the following section) into the course. A key concept of Vygotsky’s social constructivism is the zone of proximal development: the space in which scaffolded support for skills just outside of the learner’s reach is provided (Harasim, 2017).
- 6) **Elicit performance:** After the introductory, explanatory, and declarative learning modules are completed, learner performance will be elicited via active engagement with

the software programs Adobe Illustrator and CutStudio. The final hands-on vinyl cutter sign-off requires active performance, overseen by supervisory personnel with the aid of a performance checklist.

- 7) **Provide feedback:** Knowledge checks will be integrated throughout the course. These questions will be followed by either confirming or corrective feedback. If a question is answered incorrectly, the participant will be provided unlimited opportunities to retry. During the final hands-on vinyl cutter portion of the course, learners will be provided immediate feedback from supervisory personnel in a supportive and encouraging fashion.
- 8) **Assess performance:** Upon course completion learners will receive notification of passing status if all steps were completed to the standard. Successful completion will result in provision of a physical “Level 1 Badge” for the vinyl cutter. If standards are not met, students will receive notification of this result and will be provided the opportunity to retake the course if time permits.
- 9) **Enhance retention and transfer:** Online and physical job aids will be made easily available to students. The final “Resources” module will provide access to links related to covered content, education on where to access physical job aids, and information on how to access further related learning opportunities (e.g., the Aquarium’s Adobe Illustrator course, higher badge level certification courses). Encouragement to request support from supervisors in the Innovation Lab will be given. Participants will be set the challenge of taking on vinyl cutter design and creation projects from a Liberatory Design philosophy perspective.

Constructivism

A constructivist curriculum is not necessarily designed to build towards a planned outcome. Teachers support learners in constructing their own mental models. From a Vygotskian social constructivism standpoint, this world view construction is inextricably connected to social interaction. Knowledge is a function of culture, “constructed and negotiated socially” (Harasim, 2017, p. 61). While Vygotsky emphasized the role of socialization, Piaget’s cognitive constructivism championed the essential role of active participation, which allows students to organize and adapt new information into existing mental concepts (Harasim, 2017).

As the goal of this “Level 1 Badge” safety training is to prepare learners to use the Innovation Lab’s vinyl cutter safely and effectively according to standards that do not permit deviation, the subjectivist tenets of constructivism (in which learners are supported in coming to their own conclusions) do not support the general objectivist framework. However, the larger goal of the course is to prepare learners to apply this tool safely and effectively within complex creative problem-solving scenarios, a distinctly constructivist task. The guiding philosophy of the Innovation Lab, Liberatory Design, challenges practitioners to see problems, engage with key stakeholders, and take creative actions from which they will learn (National Equity Project, n.d.).

Bearing these Liberatory Design tenets in mind, thought challenges will be integrated to provoke creative individual assessment of how the vinyl cutter might be used to benefit society, aligning with Vygotsky’s social constructivism. Vygotsky’s emphasis on tools within the context of culture is of particular interest to this capstone’s work. As Harasim (2017) states, Vygotsky defined social development as “internalization of the tools of the culture” (p. 68). Tools are seen as humanity’s way of engaging with the group.

In addressing the critical aspect of relevance, constructivist learning theory elements will be implemented. After being presented with examples of how vinyl cutter use has benefitted

previous learners, integrating a cultural element in alignment with social constructivism, learners will be challenged to reflect on their own previous experiences with creation (e.g., clay modeling, Lego construction, illustration, storytelling, etc.) to facilitate connection building. A defining characteristic of a constructivist learning environment is the facilitation of reflection (Harasim, 2017).

An essential element of Piaget's cognitive constructivism is the development of symbolic thought (Mcleod, 2023). Vinyl cutter production provides a novel way to represent and communicate ideas symbolically. Learners will be guided to consider this possible use for the vinyl cutter.

While this "Level 1 Badge" safety course does not require presentation of products, the goal is to prepare learners to produce vinyl cutter products that they can share. This presentation to peers, an inherently social activity, informs learning (Mcleod, 2023). Students will be challenged to consider what products they might create and be encouraged to share these creations – in the lab or on the Monterey Bay Aquarium's Instagram page – if they feel comfortable doing so. The final section of the vinyl cutter course might include a link to the MBA's Instagram profile, providing the opportunity to view previous student productions and informing how work might be shared.

Community interactivity is integral to course design. The penultimate module requires a one-on-one skill sign-off with an expert in the Innovation Lab. This final interaction facilitates teacher feedback, promoting communication and wisdom sharing. Within the Innovation Lab, students will be able to work either individually or collaboratively. The opportunity to share final products allows for peer interaction and feedback. The learning accomplished via the group will lead to individual and community development (Harasim, 2017). The physical layout of the

Innovation Lab is an open floorplan, allowing for group interaction. Depending upon class structure, collaboration might be consciously facilitated by instructors, or it might grow naturally out of individual self-direction and communication among peers. Given the variety of learners, the degree to which collaboration takes place will vary.

Online learning is seen as highly compatible with constructivist tenets, providing students with the opportunity to readily access data, communicate and collaborate across space, encounter challenges, and reflect on learning experiences via discussion boards or online portfolios (Harasim, 2017). This course's capitalization on eLearning facilitates potential constructivist principles implementation. It is possible that an online discussion and sharing forum might be integrated into the course based upon SME feedback.

Multimedia Principles

Multimedia eLearning principles will guide selection of visual and auditory course elements with the goal of optimizing essential and deep generative processing while minimizing extraneous processing (Clark & Mayer, 2016). Choices will be influenced by an understanding of three guiding cognitive science principles – the dual channel principle (people possess separate channels for visual and auditory processing), the limited capacity principle (people can process only a limited amount of information in each channel), and the active processing principle (learning occurs via meaningful engagement) (Clark & Mayer, 2016).

The Multimedia Principle

Recognized and accepted across disciplines, the multimedia principle states that people learn better from words and pictures than from either words or pictures alone (Clark & Mayer, 2016). Intentional integration of graphics and text from the outset will facilitate learning. Representational vinyl cutter and software graphics will be presented, while distracting

decorative graphics will be minimized. Deubel's (2003) advice to use soft background colors to minimize cognitive drain will be followed. Color will also be used as an organizational tool and to contrast between on-screen items in accordance with study recommendations (Deubel, 2003).

The multimedia principle recommends teaching motor skills with the support of animation if tasks demand "complicated manual skills" (Clark & Mayer, 2016, p. 98). Concise software navigation screencasts and vinyl cutter manual operation videos will serve to educate learners. Visual cueing, or signaling, within these animations will support learner attention-direction. For example, the Adobe Illustrator menu item that audio narration is describing will be highlighted, or the portion of the vinyl cutter that is being discussed will be circled.

The Contiguity Principle

The contiguity principle recommends the placement of text near the graphic to which it corresponds, reducing extraneous processing (Clark & Mayer, 2016). While this principle may seem obvious it is easy to violate. Minimizing the need to split attention by looking back and forth between images, avoiding transient text, and designing coursework to avoid distracting navigation will optimize efficient learning. Feedback will be displayed on the same screen as the practice question (or the practice question will be included in the feedback), directions for practice exercises will be available on the same screen where those directions are to be applied, and text related to graphics will be placed next to those graphics (Clark & Mayer, 2016). In alignment with the contiguity principle, spoken word and corresponding visuals will be synchronized.

The Modality Principle

The modality principle recommends the use of audio instead of on-screen text, when possible, to facilitate essential processing (Clark & Mayer, 2016). Considerable evidence

demonstrates that audio, in place of written words, results in “significant learning gains” (Clark & Mayer, 2016, p. 130).

Capitalizing on this known learning principle, the course will incorporate audio instruction whenever possible. Narration will be scripted and approved by SMEs prior to incorporation, ensuring the most important information is relayed. It is relevant to note that limited cognitive processing and audio’s transient nature necessitates the incorporation of printed text at times. Technical terms in audio narration will be accompanied by on-screen clarifying text. For example, when “pinch rollers” are introduced in the “Vinyl Cutter Parts and Their Purposes” video, the term will appear in text on-screen.

The Redundancy Principle

The redundancy principle states that learning is enhanced when graphics and audio presentations do not include redundant on-screen text (Clark & Mayer, 2016). It is generally recommended to avoid integrating the full printed script alongside narrated visuals. When both graphics and printed words are present, the visual processing channel can be overwhelmed.

Redundancy principle violations are most glaring when the content “is system-controlled, includes words familiar to the target audience, and incorporates a lot of on-screen text” (Clark & Mayer, 2016, p. 157). This capstone course will be self-paced, allowing participant review of previous sections and for pausing and returning as needed. Familiar words will not be included on-screen, while novel terms will; judicious selection of text will serve to minimize visual channel cognitive overload.

To facilitate accessibility, learners will be provided with the option to receive information via on-screen text *or* audio, but they will not be presented the option to include both. This will prevent learners from selecting a format that does not best facilitate their cognitive processing.

Coherence Principle

The coherence principle calls for discretion in design. It recommends avoiding the use of words, sounds, or graphics that do not explicitly support learning objectives (Clark & Mayer, 2016). While it might be “[tempting] to embellish lessons in an effort to motivate learners” (Clark & Mayer, 2016, p. 168), any visual or auditory element’s inclusion ought to be predicated upon identified learning objectives.

It is thus essential to elucidate learning objectives prior to embarking on design. Careful selection of appropriate elements then serves to minimize extraneous processing (Clark & Mayer, 2016). While students may report a greater degree of attraction to exciting materials, studies show that “decorative and seductive visuals [do] not increase learning” (Clark & Mayer, 2016, p. 95) and that extraneous audio diminishes learner performance. Auditory and visual selection choices can either support or distract from learning. The identification of instructional goals for this capstone with the support of SMEs supports adherence to the coherence principle. Any “words, graphics, or sounds not central to the instructional goal” (Clark & Mayer, 2016, p. 168) will be excluded.

Segmenting Principle

According to Clark and Mayer (2016), especially for novice learners, segmentation of materials supports learning. Related concepts should be presented in context, but simply and appropriately. SME feedback on proposed agendas has facilitated the breakdown of modules into smaller chunks to avoid overwhelming learners.

Of relevance to this capstone, Clark and Mayer (2016) recommend that videos be designed to pause at fitting junctures. Not only is it the responsibility of the instructor “to present information, but also prime the appropriate cognitive processing in the learner” (Clark & Mayer,

2016, p. 201). The results of a study in which an animation included a pause button versus excluded a pause button are strikingly pertinent. No difference was found between learning outcomes, “primarily because most learners did not use the pause button” (p. 224). Novice learners often do not know when it is appropriate to stop and reflect. Priming the learner to break for concept processing is the responsibility of the designer.

Personalization Principle

The personalization principle states that eLearning is improved when conversational style, polite wording, and audio narration with human – as opposed to robotic – voices are employed (Clark & Mayer, 2016). The goal is to “induce the learner to engage with the computer as a social conversational partner” (Clark & Mayer, 2016, p. 195). The feeling of a “social presence” (Clark & Mayer, 2016, p. 201) induces higher engagement. Scripts for this capstone’s modules will utilize conversational first- and second-person pronouns, the tone of narration will be encouraging and polite, and spoken words will come from real human voices.

The embodiment principle calls for instructional online entities to “act like humans – using human-like gestures, movements, facial expressions, and eye gaze” (Clark & Mayer, 2016, p. 210) to optimize engagement and learning. Filmed demonstration videos will adhere to the embodiment principle. Screencast instructional videos will include video of the narrating instructor.

Development Plan

The Fall 2022 semester was devoted to establishing the client (the Monterey Bay Aquarium’s Innovation Lab), identifying the primary SME (Education Programs Director Katy Scott), completing assessments, and building out concepts for the projected deliverable. Ongoing communications with SMEs continue to guide content and design.

The final capstone deliverable is projected for completion between late October and early November 2023. Implementation data analysis and final reporting will follow in December 2023 preceding December graduation from the MIST (Master's in Instructional Science and Technology) program.

The capstone proposal will be finalized in the Spring 2023 IST 520 course. Spring 2023 will also see the creation of approximately three modules, including content and assessments. These modules will be created in conjunction with SMEs and will be presented to them for feedback.

In Summer 2023, testing measurements and assessments will be created, and as much of the final deliverable as possible will be created. This build-out will facilitate course test piloting to garner participant feedback, guiding final product changes. Education Programs Director Katy Scott has provided notification that this timeline aligns well with upcoming Innovation Lab summer field trips. It is anticipated that a cohort of approximately 25 teachers visiting the Innovation Lab from June 26 – 30, 2023 may be recruited to complete existing coursework and provide feedback. Innovation Lab high school volunteers may also provide test piloting support.

Project Deliverables & Schedule/Timeline

1. Learning Objectives

- a. *Status:* Learning objectives were formulated based on initial meetings, email communications with MBA stakeholders, and review of existing materials. A March 2023 SME meeting with Education Programs Director Katy Scott and Senior Education Specialist and Innovation Lab manager Luis David Calderon confirmed the appropriateness of proposed learning objectives.
- b. *Estimated finalization date:* April 2023

- c. Ongoing communications as portions of the course are built will facilitate optimization, but general approval for proposed learning objectives has been obtained from the SMEs.

2. Storyboarding the Fourteen Proposed Course Modules

- a. *Status:* Upcoming
- b. *Estimated finalization date:* April – October 2023
- c. The proposed vinyl cutter course will include fourteen eLearning modules with integrated assessments and learning activities. Storyboards will be created for each of these modules which will detail the script, visual video content, quiz questions and assessments, guided activity instructions, and linked resources. These storyboards will be drafted and presented to SMEs for approval, facilitating early optimization. Storyboards for three modules (“Vinyl Cutter Parts and Their Purposes,” “Materials You Can Use with the Vinyl Cutter,” and “Vinyl Cutter Safety” were completed and approved by SMEs in April 2023).

3. Module Draft and Pilot Test

- a. *Status:* Upcoming
- b. *Estimated finalization date:* April – July 2023
- c. Initial module drafts will follow the approval of storyboarded strategies developed in the proposal. Formative evaluation testing will be conducted to ensure the modules are easy to navigate and that they meet learning objectives. Volunteer summer field trip participants and Innovation Lab volunteers will support the formative evaluation process. Ideally, participant groups will reflect a range of ages and experience levels,

facilitating evaluation across the anticipated spectrum of student backgrounds.

Feedback will be elicited from sample groups and the SMEs, guiding optimization and revision.

4. Finalized Course

- a. *Status*: Upcoming
- b. *Estimated finalization date*: October – November 2023
- c. The final course will reflect the feedback obtained from the test pilot participants, SMEs, and Innovation Lab stakeholders. I will collaborate with the Monterey Bay Aquarium’s education team via the SMEs to obtain final approval and course launch dates.

Potential Challenges & Contingency Planning

While the Monterey Bay Aquarium’s education team currently faces many demands, primary subject matter expert and Education Programs Director Katy Scott has been generous with her time and support. Multiple face-to-face meetings, a tour of the Innovation Lab, introduction to Innovation Lab team members, and online Zoom meetings have been provided by Katy. While it is reported that consistent SME communication can be one of the greatest challenges students in the MIST program face, SME feedback has been reliable. Additionally, the MBA team member who facilitated this SME relationship – the MBA Director of Learning and Engagement, Brianne Fitzgerald – is a former MIST student who has offered advisement as needed.

Despite these advantages, it is wise to anticipate time management as a possible challenge. In collaboration with my MIST program capstone advisor, Dr. Sarah Evanick, it is planned to communicate with the Innovation Lab’s education team well ahead of time. This will

ensure that the timeline for preliminary modules provision, test piloting, and final deliverables is known. Providing ample time for coordination will allow contingency arrangement if unforeseeable circumstances necessitate rescheduling. Having deadlines in place with a degree of time cushioning will prevent unforeseen technology malfunctions, emergencies, etc. from derailing plans.

A compelling reason for my personal interest in the MIST program was a desire to build technical competence. With limited experience, one of the greatest anticipated hurdles is attaining proficiency with the technologies utilized to create eLearning modules. The introduction to multiple relevant tools in IST 501 and IST 511 under Professor Beem's tutelage, and the orientation to multiple eLearning authoring tools in IST 526 by Dr. Miguel Lara, have been invaluable. Not only has a baseline understanding of available software and their functions been provided, but completing hands-on assignments imparted an understanding that answers to questions that arise are available via software guides and the internet community.

Implementation Plan

The final eLearning course will be made available via the Monterey Bay Aquarium's learning management system (LMS) Thinkific. The online portion of the vinyl cutter course will allow for asynchronous completion in the homes of Innovation Lab participants. As Stolovitch and Keeps (2011) point out, this augments the ability of people in diverse locations to access the training in ideal timeframes, however often they feel is necessary. Additionally, virtual accessibility will cut down on time and personnel resource utilization in the Innovation Lab, maximizing efficiency.

The course's second to last module is a hands-on vinyl cutter skill sign-off in the Innovation Lab, overseen by certified supervisory personnel. This learning experience in an

authentic environment is designed to maximize transfer (Stolovitch & Keeps, 2011). Guidance will be provided to students by the supervisor with the support of an authorized performance checklist that supports assessment of whether the learner has met objectives, facilitating corrective and supportive feedback (Stolovitch & Keeps, 2011).

Instructors and/or Administrators

The primary subject matter expert for this project is the Monterey Bay Aquarium Education Programs Director Katy Scott. She is the main point of contact and is responsible for coordination throughout and provision of final sign-off. It is possible that other MBA Innovation Lab team members, including Senior Education Specialist and Innovation Lab manager Luis David Calderon and Vice President of Education Dr. Jenny de la Hoz, may also be involved in the final sign-off process.

The course's design plan includes the creation of multiple instructional videos. Katy Scott has communicated that professional videography tools, filming personnel, and talent are available through the MBA. Initial Innovation Lab filming with the support of MBA resources was completed on the 14th, 16th, 18th, and 20th of April 2023. Future filming days will be scheduled in the Fall 2023 semester. Administrative personnel will support the scheduling of in-person instructional video beta testing, facilitating direct feedback.

The final section of the course requires hands-on vinyl cutter sign-off with certified instructors. The degree of training required to prepare the certified personnel to support this portion of the sign-off needs to be determined. It is possible that this training is already integrated into higher Badge Level sign-offs and may not require this capstone work's support. Minimally, arrangements to coordinate supervisor availability will be necessary. Supervisors will

need to be available for meetings that finalize the sign-off process. A schedule will need to be built to establish supervisor availability for in-person sign-offs.

Other Implementation Requirements

The majority of the course's modules will be completed online and will be available in the Thinkific LMS Innovation Lab training section. The final module must be completed in the Innovation Lab via the established field trip program.

This capstone project was provided by the Innovation Lab team and is approved by the Monterey Bay Aquarium for creation. The Innovation Lab field trip schedule is well-established; it is assumed that marketing of the course is unnecessary, but this will be confirmed with the SMEs.

Evaluation Plan

The course will undergo multiple formative evaluations as well as final summative evaluation. SME and Innovation Lab team members' feedback will comprise most of the formative evaluation data. Summer field trip Innovation Lab participants and volunteers will provide valuable user feedback in the test piloting phase in June – July 2023. Summative evaluation will be conducted in the final stage, projected for October – November 2023, facilitating final modifications in December 2023 before delivery.

Formative Evaluation

Formative module evaluations will take place throughout the creation process. Rothwell et al. (2016) describes four major formative evaluation methods. The intention is to implement the formative evaluation strategies they describe of (1) expert reviews by SMEs and (2) individual and (3) group pilot testing.

Storyboards, scripts, and drafted proposals will be presented to the SMEs for feedback. Regular meetings with SMEs will facilitate communications that guide early corrective action. As Rothwell et al. (2016) advise, SME feedback will be elicited on course materials, audiovisuals, case examples, and content. Catching mistakes and areas that require optimization early in the process will minimize the need for massive revisions late in development.

Gathering ample user feedback will further support the identification of modification needs – of delivery style, formatting, questions, pause points, general clarity, etc. Innovation Lab summer field trip participant course participation will provide most of the user feedback. As the course is to be housed in the LMS Thinkific, there may be limitations in the ability to elicit thoughts from users not enrolled in the MBA’s education program. Preliminary versions housed in the authoring tool outside the LMS may allow classmates, professors, etc. to participate and provide additional critiques. As Stolovitch and Keeps (2011) assert, it is critical to gather detailed feedback on the front-end when creating eLearning content; when the online course is launched, many users may not have access to instructor support.

Summative Evaluation

The Kirkpatrick Four-Level Evaluation framework is comprised of (1) learner satisfaction (“Reaction”), (2) new knowledge or skill acquisition (“Learning”), (3) implementation or transfer of knowledge or skill to the workplace (“Application”), and (4) actual impact on the organization’s desired outcomes (Rothwell et al., 2016). Beyond this four-level evaluation framework, the Phillips ROI model adds an additional fifth level: return-on-investment (ROI) (Mindflash, n.d.).

- **Reaction (Level 1)** will be evaluated via learner surveys administered upon completion of the course. It is important to remember that, while this type of

assessment provides valuable data, it is highly subjective and studies have demonstrated little correlation between learner reaction and actual learning transfer (Rothwell et al., 2016).

- **Learning (Level 2)** will be evaluated throughout the course via check-in quizzes and the final procedural skill sign-off facilitated by supervisors. Data collected from these quizzes and behavioral checklists performance may be utilized for statistical analyses.
- **Application (Level 3)** is unlikely to receive systematic evaluation. Learners may be encouraged to provide feedback on their future projects within the Innovation Lab. Documentation of created works after training completion could provide data on the degree to which learning was implemented. I will communicate with SMEs and the Innovation Lab team to determine if and how they would like to gather this type of data.
- **Impact (Level 4)** may be measured in determining the degree to which asynchronous completion of online portions of the course reduces the number of personnel and degree of labor required to sign off participants. If the dissemination of this course demonstrates an impact that reduces resource utilization in the Innovation Lab, it may support the creation of further instructional modules that address the rest of the tools the Lab houses. The plan to fully create online trainings is, however, already in place.
- If completed, data collected to assess the 'Impact' could support evaluation of **ROI (Level 5)**. Quantitative ROI evaluation would likely prove challenging, but

as this capstone course is largely student-created, it is hoped that the ROI benefits the organization.

As Rothwell et al. (2016) assert, the resources and effort that evaluation requires increases as the levels rise. Communication with SMEs and key stakeholders will determine the degree to which evaluation of reaction, learning, behavior, impact, and ROI are desired.

Evaluation Summary

The development, implementation, and evaluation of this course on safe and effective vinyl cutter use for MBA Innovation Lab participants is largely theoretical at this point, but plans are in place and SME approval has been obtained on numerous sections. Multiple videos have been shot and edited, and initial module creation work is ongoing. This capstone proposal provides a framework around which specific goals and timelines can be organized.

Creation of storyboards, initial modules, and preliminary mock-ups will facilitate initial and ongoing formative evaluations that dictate modifications and allocation of labor. Feedback from the SMEs and stakeholders in the Innovation Lab will be critical for direction, as will the results of pilot testing with summer field trip Innovation Lab participants and volunteers.

The depth and degree of desired summative evaluation will be discussed with the SMEs and Innovation Lab team members. Their input will determine if assessment is to go beyond the initial levels of “Reaction” and “Learning.”

The development, implementation, and evaluation of this course will be conducted in a collaborative fashion. Efforts are ongoing to create storyboards, film videos, and create preliminary modules. It is hoped that the creation of this course will benefit the Monterey Bay Aquarium Innovation Lab team and many of the Innovation Lab’s participants in years to come.

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