

UNIVERSIDAD PARA LA COOPERACION INTERNACIONAL
(UCI)

PROJECT MANAGEMENT PLAN FOR DESIGNING AN INTERACTIVE
VIRTUAL SCIENCE LABORATORY

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DEDICATION

This project is dedicated to my mother, who passed away on May 27, 2023.

She devoted her life to making sure I had every opportunity to grow and succeed. She was my greatest supporter and celebrated every milestone with me. Before she passed, she shared in my excitement as I began this new journey of pursuing this degree.

Thank you, Mom, for the countless sacrifices you made to help me get here. In the hardest moments, it was your memory that gave me the strength to keep going. I am who I am because of you. I carry you with me always in my thoughts, in my heart, and in the purpose that guides me forward.

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Thank you to my professors and the entire academic team at Universidad para la Cooperación Internacional (UCI) for fostering an environment of meaningful learning and for making knowledge truly accessible.

To my husband, Dominique Fabro, thank you for standing by me throughout this academic journey. Your patience, sacrifices, and support made this accomplishment possible.

Finally, I thank my family and friends for their encouragement throughout this Master's program. Thank you for believing in me and reminding me that I could accomplish what I set my mind to.

ABSTRACT

The objective of this document is to develop a Project Management Plan, based on the standards of the Project Management Institute, to guide the design of an Interactive Virtual Science Laboratory (IVSL) in Belize. Traditional science labs present many challenges: students face limited equipment, high fees, and pressure from only one chance to complete experiments. Online and distance learners lack the hands-on experience needed to fully understand and apply scientific theory. Teachers have heavy grading workloads and limited time for individual support. Institutions struggle with high costs and limited resources to maintain or improve lab facilities. These issues reduce the quality of science education and show the need for more flexible and accessible learning options.

Catalyst Educational Services, a newly established educational services company, is the proposed organization to develop the design of the virtual lab. The final product of this Final Graduation Project (FGP) is a Project Management Plan that includes a Project Charter and the management plans for scope, schedule, cost, quality, resources, communications, risks, procurement, and stakeholder engagement. These deliverables are developed using analytic-synthetic, inductive-deductive, and statistical methods. Information is gathered from structured interviews, surveys, academic literature, and the PMBOK® Guide (6th and 7th editions). This Project Management Plan provides a foundation to help Catalyst Educational Services design the country's first IVSL.

Keywords: Project Management Plan, Interactive Virtual Science Laboratory, Science Education, Distance Learning

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ABBREVIATIONS AND ACRONYMS

AC- Actual Cost

ATLIB- Association of Tertiary Level Institutions in Belize

CCB- Change Control Board

CPI- Cost Performance Index

CPM- Critical Path Method

CV- Cost Variance

CXC- Caribbean Examinations Council

EAC- Estimate at Completion

ETC- Estimate to Complete

EV- Earned Value

EVA- Earned Value Analysis

EVM- Earned Value Management

FFP- Firm Fixed Price

FGP- Final Graduation Project

GPM- Green Project Management

IT- Information Technology

ITT- Invitations to Tender

IVSL- Interactive Virtual Science Laboratory

LMS- Learning Management Software

OBS- Organizational Breakdown Structure

P5IA- P5 Impact Analysis

PCS- Project Steering Committee

PDCA- Plan-Do-Check-Act

PMI- Project Management Institute

PV- Planned Value

RACI- Responsible Accountable Consulted Informed

RAM- Responsibility Assignment Matrix

RBS- Resource Breakdown Structure

RBS- Risk Breakdown Structure

RFP- Requests for Proposal

RFQ- Requests for Quotation

SDG- Sustainable Development Goals

SME- Subject Matter Expert

SOW- Statement of Work

SPI- Schedule Performance Index

SV- Schedule Variance

SWOT- Strengths Weaknesses Opportunities Threats

TCPI- To-Complete Performance Index

TOR- Terms of Reference

VR- Virtual Reality

WBS- Work Breakdown Structure

EXECUTIVE SUMMARY

Science education in Belize has long depended on traditional physical laboratories that require space, equipment, chemicals, and staff. However, not all institutions in Belize can afford or maintain these facilities. This issue creates challenges for students, such as outdated or limited lab equipment, high lab fees, and fewer opportunities to do experiments. Many students only get one chance to complete an experiment, which creates pressure and causes stress. If they do not understand the procedure, there is often no time to ask questions or try again. Online and distance learning students usually miss out on lab activities completely and only learn theory. Teachers also struggle with heavy grading workloads and limited time to support students. These problems reduce the overall quality of science education in the country.

The growth of digital technology has opened new ways to improve science education. In many countries, Interactive Virtual Science Laboratories (IVSLs) are being used to make science learning more flexible, fun, and affordable. These virtual labs use simulations to let students do experiments online. Students can repeat activities, get feedback right away, and access the lab anytime from anywhere. Despite the benefits, this type of laboratory is not yet available in Belize. Catalyst Educational Services, a new education company led by science educator Aisha Leiva, proposed the design of an IVSL to help solve these problems and support better science learning in the country.

The general objective of this project was to develop a Project Management Plan, based on the standards of the Project Management Institute, to guide the effective design of an interactive virtual science laboratory. The specific objectives were: to create a Project Charter that formally authorizes the project and establishes its purpose and objectives, to create a Scope Management Plan to define the project's scope, requirements, and deliverables, to create a Schedule Management Plan to outline the project timeline and key milestones for the design of the interactive virtual science laboratory, to create a Cost Management Plan to develop cost estimates and establish the budget for the design of the interactive virtual science laboratory, to create a Quality Management Plan to define quality standards and ensure the design meets educational and technological requirements, to create a Resource Management Plan to determine and allocate the resources needed for the design of the interactive virtual science laboratory, to create a Communication Management Plan to establish how project information will be shared, ensuring clear and effective communication among stakeholders, to create a Risk Management Plan to identify potential risks, assess their impact, and develop strategies to manage them, to create a Procurement Management Plan to define the process for acquiring external resources and services required, and to create a Stakeholder Engagement Plan to identify key stakeholders and define how they will be engaged throughout the project.

To achieve the objectives, this project followed a structured methodological framework based on PMI standards. Both primary and secondary sources were used. Primary data was collected through structured interviews and surveys with students, teachers, administrators, and IT professionals to gather firsthand insights on existing challenges and expectations. Secondary sources included the PMBOK® Guide (6th and 7th editions), textbooks, journal

articles, and reports related to project management and educational technology. These sources were carefully selected to support the development of each component of the Project Management Plan.

The research methods applied included the analytic-synthetic method, inductive-deductive method, and statistical method. The analytic-synthetic method was used to break down and study examples of virtual science labs, then combine the best ideas into a useful design plan. The inductive-deductive method helped make sense of feedback from stakeholders and connect those ideas to project management principles. The statistical method was used to study survey results and understand what stakeholders preferred. Tools from the PMBOK® Guide were used for each objective. This approach helped create a Project Management Plan that was based on real data, focused on the project goals, and followed best practices for designing an Interactive Virtual Science Laboratory in Belize.

The conclusions from this project showed that it was possible to create a clear and well-organized Project Management Plan for designing an Interactive Virtual Science Laboratory (IVSL). The plan was successfully developed for Catalyst Educational Services to support the design of a virtual lab that helps remote and online students in Belize learn science in a more effective and engaging way. It covered key knowledge areas such as Scope, Schedule, Cost, Quality, Resource, Communications, Risk, Procurement, and Stakeholder Management. Each plan used tools, techniques, and outputs that fit the specific needs of the project. Change control processes were also included to manage updates in a structured and traceable way.

The recommendations for this project are based on the ten specific objectives and are meant to support the successful design of the Interactive Virtual Science Laboratory (IVSL). They focus on keeping project documents and tools like the Charter, Scope Baseline, Gantt chart, Risk Register, and Stakeholder Engagement Matrix updated and in use throughout the project. Good communication, teamwork, and regular checks on cost, quality, and stakeholder involvement are also important. It is recommended that the Project Management Plan be used as a guide for future phases or similar projects, which will help Catalyst Educational Services stay organized, manage changes properly, and continue creating useful and accessible science learning tools for students in Belize.

1 INTRODUCTION

Laboratory activities are essential components of science courses. They provide students with practical experiences to better understand scientific concepts. Traditionally, science laboratories take place in physical settings, allowing students to directly engage in experiments and gain hands-on experience. In today's world, digital transformation is reshaping many areas and science education is no exception. This transformation leads educators to explore new methods for teaching science. Virtual laboratories are digital platforms that simulate real science experiments. They offer students a new way to learn science without using a physical lab. Students can access these virtual labs online from anywhere. This flexibility makes learning science easier and more convenient and includes students who may not have access to science equipment. In virtual labs, students can complete assessments and lab reports digitally, making it simpler for teachers to track progress. Virtual laboratories benefit not only students and teachers but also the environment. They reduce the need for physical materials and contribute to sustainability efforts in the educational settings.

Currently, this type of interactive virtual laboratory is not yet available in Belize. Successfully delivering new educational solutions requires careful planning and organization. Introducing new technology in education involves properly managing resources, planning timelines, and meeting stakeholder expectations. Without clear planning, these projects can face challenges. Project management provides a systematic approach to organizing, planning, and executing projects to achieve desired goals (PMI, 2021). This project proposes developing a Project Management Plan for designing an IVSL at Catalyst Educational Services in Belize.

1.1. Background

For over ten years, educational professional Aisha Leiva has provided independent educational services in Belize City, Belize. These services include tutoring, curriculum development, adjunct lecturing, and consultancy in science education. Through these experiences, Leiva gained direct insight into how students learn science and which teaching methods were successful in classrooms and labs. She also observed common challenges that teachers and students face, both in-person and online, in traditional science education particularly in laboratory activities. These observations motivated Leiva to propose the expansion of her professional services to a structured educational company called Catalyst Educational Services. This proposed company would focus on creating innovative, digital learning tools designed to improve the learning experience for both students and teachers. A key initiative of this new company is the design of an Interactive Virtual Science Laboratory (IVSL). Virtual laboratories use computer simulations to recreate real science experiments online, allowing students to participate digitally without needing physical labs (Bazie & Lemma, 2024).

Currently, ISVLs are not available in Belize. As a result, students, teachers, and institutions continue to face specific issues related to traditional lab settings. The details of these issues and how they specifically impact students, teachers, and educational institutions will be explained in the next section. The purpose of this project is to develop a Project Management Plan for designing the IVSL. This project will focus only on the planning aspects required for the laboratory's design, without involving its actual development or implementation. The goal is to create a clear, structured plan that incorporates input from key stakeholders, including students, teachers, administrators, and subject matter experts. This

approach will help ensure that the IVSL is designed to effectively meet the educational needs identified through Leiva's professional experiences and stakeholder feedback.

1.2. Statement of the problem

Catalyst Educational Services aims to address several challenges observed by educational professional Aisha Leiva, as well as additional issues documented while researching. The proposed design of the Interactive Virtual Science Laboratory (IVSL) represents an opportunity to solve current problems experienced by students, teachers, and institutions in Belize. Traditional science laboratories require dedicated physical space, special equipment, chemical supplies, maintenance, and a laboratory technician. These required resources add up to significant financial costs for institutions (Bazie & Lemma, 2024). Many institutions in Belize struggle to find funding for these science laboratories, which often results in limited or outdated supplies and equipment and lack of a laboratory technician. Additionally, students are required to pay lab fees which can place a financial burden on them and their families. Without access to alternatives, these expenses and resource limitations negatively affect the quality of science education available to Belizean students.

Secondly, traditional lab sessions often create scheduling conflicts and logistical challenges. Since labs require students to be physically present at specified times, working or commuting students face difficulties fitting lab sessions into their schedules. This problem is even greater for online students who do not experience the practical laboratory activity at all. These students must rely solely on theoretical learning, missing the important hands-on component of science education. Without practical experience, students often struggle to fully understand and apply scientific concepts.

Another significant problem involves student confidence. Traditional labs typically allow students only one attempt to perform experiments due to time and resource constraints. As there is only chance to get it right, students feel pressure to perform perfectly, causing anxiety and stress (Shivam & Wagoner, 2020). This stress reduces their ability to learn effectively. In addition, students who have difficulty understanding lab procedures or using equipment have limited opportunities to seek clarification. They must focus on completing the experiment properly within the set time frame. In the end, the overall goal of laboratory learning is not achieved because students are unable to clearly connect theoretical concepts with practical experiences.

Teachers also face challenges with traditional laboratories. Instructors spend extensive amounts of time manually grading lab reports and assessments. This process reduces the time they can spend supporting students, preparing lessons, and grading assessments for other courses. As a teacher herself, Leiva directly experienced these challenges and understands the strain placed on educators by manual grading and administrative tasks. This paperwork overload restricts teachers' ability to provide quality, individualized attention to students. The heavy grading workload often leads to delayed feedback, making it harder for students to understand their mistakes and improve. When feedback is not given promptly, students may continue repeating the same errors, affecting their learning and progress.

Currently, Belize does not have a clear framework for designing innovative educational projects like IVSLs. Without a structured Project Management Plan, projects can face common problems such as unclear scope, poor scheduling, inaccurate budgeting, inconsistent quality standards, insufficient stakeholder engagement, and unmanaged risks. The lack of systematic planning can cause digital education projects, intended to solve

existing educational challenges, to fail. Therefore, developing a Project Management Plan based on standards from the Project Management Institute (PMI) is essential. This structured plan will guide the design of the IVSL project and directly address issues such as high costs, learning effectiveness, student anxiety, and teacher workload. By clearly defining project requirements, managing resources carefully, identifying risks early, and involving stakeholders consistently, the Project Management Plan will help ensure the successful design of the IVSL.

1.3. Purpose

The design of the IVSL is important because it directly responds to challenges previously mentioned. These include the high cost of running physical labs, limited equipment and materials, increased stress for students, and the large amount of time teachers spend grading lab reports. These problems have existed for many years, but no effective alternative has been presented to fix them. This project will develop a Project Management Plan to guide the design of an IVSL that meets educational needs and improves science learning in Belize.

This project serves as an opportunity to introduce an innovative solution that is more engaging, effective, accessible, and cost saving. Virtual laboratories have been proven to improve science learning in other countries by making experiments more accessible and interactive. Studies show that students who use virtual labs score higher on assessments and gain a better understanding of science concepts compared to those who only use traditional methods (Bazie & Lemma, 2024). Virtual labs allow students to work at their own pace, repeat experiments, and receive immediate feedback. These features create a better learning environment especially for students who feel stressed or left behind in traditional labs

(Shivam & Wagoner, 2020). As a result, students can build confidence, reduce anxiety, and focus more on learning and understanding.

Instructors will benefit from automated assessments by reducing their grading workload, giving them more time to support students. This additional time will improve the quality of teaching and allow for faster, more helpful feedback for students (McGraw Hill, 2022). By designing the IVSL to include automated grading and progress tracking, the project aims to improve efficiency for both students and teachers.

This project also helps make science education accessible to more students. Many students in Belize live far from campuses, work, and can only attend classes online. Without access to a physical lab, these students miss out on hands-on learning. A well-designed virtual lab can provide these students with the same opportunities as those who attend in person. The IVSL will be designed to be compatible with the common learning platforms used by institutions in the country. This compatibility will make it easier for institutions to adopt and for teachers and students to use.

Virtual labs may cost more to design, develop, and implement, but they help save money in the long run. Once the virtual lab is created, it can be used for several courses and removes the costs of materials and supplies, utilities, maintenance, and hiring a lab technician. Over time, virtual labs become a more affordable and practical way to support science education for both institutions and students (Design and Implementation of Virtual Laboratories for Higher Education Sustainability, 2022).

This structured Project Management Plan will integrate recognized PMI standards to provide clear guidelines on scope management, scheduling, cost estimation, quality assurance, resource allocation, stakeholder communication, risk mitigation, and procurement procedures. It will enable Catalyst Educational Services to clearly define and manage each

stage of the IVSL design process. This approach ensures that the project's outcomes align closely with the educational needs, technological requirements, and institutional expectations. This ultimately contributes to successful project delivery and sustainable improvements in Belizean science education.

1.4. General objective

To develop a structured Project Management Plan, based on the standards of the Project Management Institute, to guide the effective design of an interactive virtual science laboratory.

1.5. Specific objectives

1. To create a Project Charter that formally authorizes the project and establishes its purpose and objectives.
2. To create a Scope Management Plan to define the project's scope, requirements, and deliverables.
3. To create a Schedule Management Plan to outline the project timeline and key milestones for the design of the interactive virtual science laboratory.
4. To create a Cost Management Plan to develop cost estimates and establish the budget for the design of the interactive virtual science laboratory.
5. To create a Quality Management Plan to define quality standards and ensure the design meets educational and technological requirements.
6. To create a Resource Management Plan to determine and allocate the resources needed for the design of the interactive virtual science laboratory.
7. To create a Communication Management Plan to establish how project information will be shared, ensuring clear and effective communication among stakeholders.

8. To create a Risk Management Plan to identify potential risks, assess their impact, and develop strategies to manage them.
9. To create a Procurement Management Plan to define the process for acquiring external resources and services required.
10. To create a Stakeholder Engagement Plan to identify key stakeholders and define how they will be engaged throughout the project.

2 THEORETICAL FRAMEWORK

2.1 Company/Enterprise framework

2.1.1 Company/Enterprise background

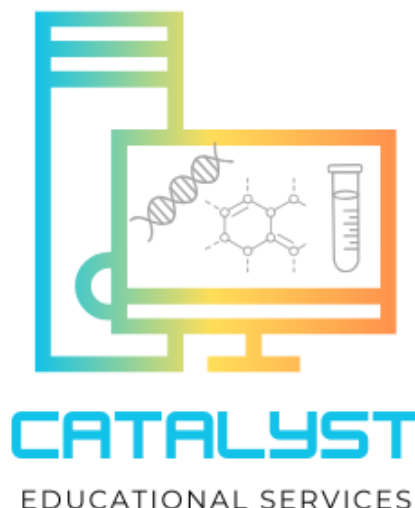
For over a decade, Aisha Leiva has provided independent educational services, including tutoring, adjunct lecturing, curriculum development, and consultancy. These services are formally recognized as a taxable business in Belize and have played a crucial role in supporting students, educators, and academic institutions. With a vision for growth, Leiva's aim is to transition from an independent professional service provider into an established education company under the name Catalyst Educational Services. This fully remote company will offer a wide range of innovative educational solutions, including digital learning tools, interactive resources, and online instructional methods.

As part of this Final Graduation Project (FGP), a Project Management Plan is being developed to design an Interactive Virtual Science Laboratory. This project tackles major challenges in traditional science education, such as high lab costs, limited access for virtual students, and time-consuming grading for instructors. Virtual labs offer structured, interactive experiments that improve accessibility and engagement. By providing a more immersive self-paced experience, students can better understand concepts, stay more engaged, and achieve better results.

Although the company has not yet been fully established in its expanded form, this FGP research will lay the foundation for its development. Designing an Interactive Virtual Science Laboratory will act as a pilot project, helping to refine the company's strategies. The logo for Catalyst Educational Services was designed to visually represent the brand as

it prepares to transition into a structured business. The logo for Catalyst Educational Services is shown below in **Figure 1**.

Figure 1. Catalyst Educational Services Logo



Note. Own work.

2.1.2 Mission and vision statements

Since Catalyst Educational Services is still in the process of becoming a structured business, there is currently no existing mission or vision statement. However, the statements below have been developed based on the company's goal of improving science education through digital learning tools and interactive virtual experiences. The Final Graduation Project (FGP) supports this goal by designing the Interactive Virtual Science Laboratory. This lab will help bridge gaps in traditional science education by providing a more accessible, engaging, and effective learning experience.

Mission Statement

To provide digital learning tools that make science education more accessible, engaging, and effective through interactive resources and technology-driven solutions.

Vision Statement

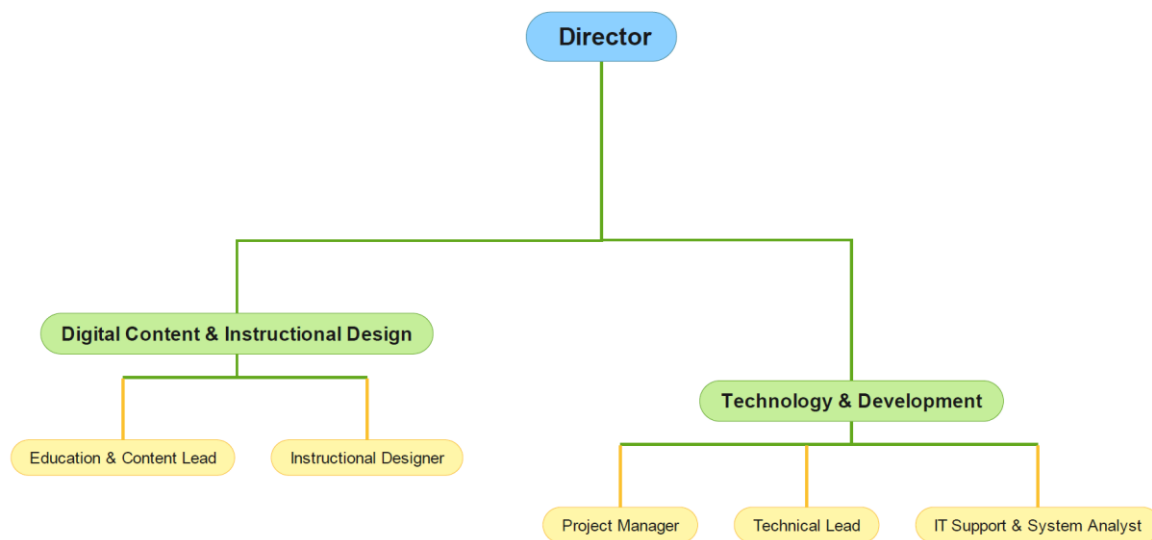
To become a leading provider of interactive digital learning solutions that enhance science education and expand access to quality learning experiences.

2.1.3 Organizational structure

Catalyst Educational Services will start with a small team, with some roles being part-time, contract-based, or outsourced. The Director will oversee strategy, business planning, and overall coordination to ensure the company moves in the right direction. The Digital Content & Instructional Design Division will focus on creating educational materials for the virtual lab. An Education & Content Lead will guide the development of interactive learning materials, making sure the lab meets educational standards. Instructional designers, who may be hired on a contract basis, will help develop digital content.

The Technology & Development Division will handle the technical side of the project. A Project Manager will oversee day-to-day operations, making sure tasks are completed on time and that all teams are working together efficiently. A Technical Lead, who may be contracted or outsourced, will design the structure and functionality of the virtual lab. IT support and system analysts may also be outsourced to check whether the lab is technically feasible and scalable. Since the Final Graduation Project (FGP) focuses only on the design of the Interactive Virtual Science Laboratory, some roles will not be staffed yet. If the company decides to develop and launch the lab in the future, more specialized roles may be added. The organizational structure is shown below in **Figure 2**.

Figure 2. Catalyst Educational Services Organizational Structure



Note. Own work.

2.1.4 Products Offered

Catalyst Educational Services provides digital learning services that enhance virtual education through interactive and technology-driven solutions. These services are designed to support students, educators, and institutions by offering innovative ways to engage with educational content.

The main services offered include:

- Virtual Learning Design – Designing immersive and interactive digital learning environments, such as the Interactive Virtual Science Laboratory, that allow students to engage in simulation-based learning.
- Digital Content Development – Designing educational resources such as online courses, and interactive study materials to enhance digital education and provide flexible learning experiences.

- Academic Support Solutions – Offering assessment tools, automated grading, and instructional support to improve teaching and student engagement in digital learning environments.

2.2 Project Management concepts

2.2.1 Project management principles

The PMBOK Guide 7th Edition (PMI, 2021) introduces 12 fundamental project management principles that guide professionals in effectively managing projects. These principles are rooted in PMI's core ethical values of responsibility, respect, fairness, and honesty. The following are the 12 principles of project management and their application to the Final Graduation Project (FGP) – Project Management Plan for Designing an Interactive Virtual Science Laboratory.

- Be a Diligent, Respectful, and Caring Steward- Ethical and professional standards were followed by ensuring transparent documentation, accountability, and compliance with university policies and PMI guidelines.
- Create a Collaborative Project Team Environment- Collaboration was encouraged by incorporating input from faculty, students, and subject matter experts to ensure the project aligned with academic and institutional needs.
- Effectively Engage with Stakeholders- Key stakeholders, including educators, students, and institutional representatives, were identified and engaged to define project requirements and expectations.
- Focus on Value- The virtual science lab was designed to increase accessibility and reduce costs which would provide students with an interactive and scalable alternative to traditional laboratory experiences.

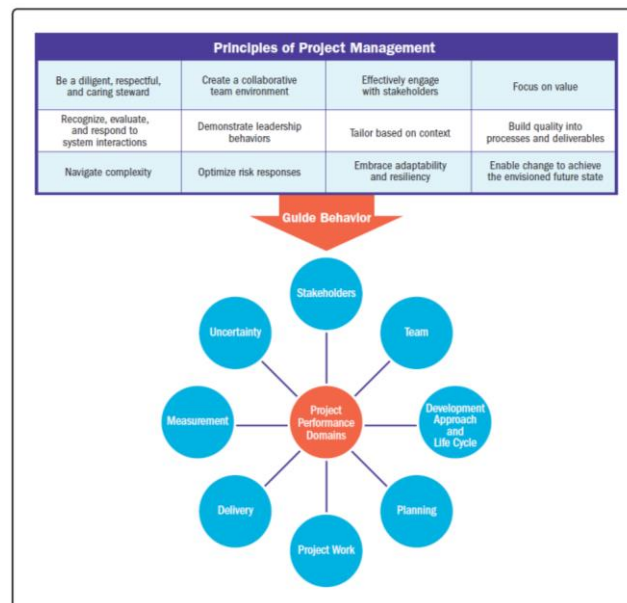
- Recognize, Evaluate, and Respond to System Interactions- Consideration was given to how the virtual science lab would integrate with existing digital learning platforms, institutional policies, and technological frameworks.
- Demonstrate Leadership Behaviors- Effective leadership ensured that the Project Management Plan was well-structured and decisions about the design process were made carefully.
- Tailor Based on Context- The project management approach was customized to fit the academic setting, ensuring structured research, planning, and alignment with best practices.
- Build Quality into Processes and Deliverables- Quality considerations were incorporated to ensure usability, effectiveness, and alignment with educational standards, validating the feasibility of the virtual science lab.
- Navigate Complexity- Aligning technological capabilities with academic requirements and institutional policies created complexity, but best practices in virtual learning helped guide the planning process.
- Optimize Risk Responses- Potential risks such as technological limitations, cost constraints, and implementation challenges were identified, and response strategies were developed to mitigate their impact.
- Embrace Adaptability and Resiliency- A structured approach was taken to track changes, incorporate feedback, and adjust strategies as needed, ensuring flexibility without compromising objectives
- Enable Change to Achieve the Envisioned Future State- This FGP supports the future of science education by designing a virtual lab that is scalable, innovative,

and cost-effective, making it easier for institutions to adopt and integrate into digital learning.

2.2.2 Project management domains

According to PMBOK 7th Edition, project performance domains represent groups of related activities that collectively contribute to project success (PMI, 2021). There are 8 performance domains which include stakeholders, team, development approach and life cycle, planning, project work, delivery, measurement, and uncertainty. As shown in **Figure 3** below, project management principles are located above the performance domains and provide guidance to the activities within each domain (PMI, 2021). Domains help guide the planning, design decisions, and stakeholder involvement needed to create a practical and effective interactive virtual science laboratory.

Figure 3. Project Management Principles and Project Performance Domains



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*, Seventh Edition. Project Management Institute (PMI), 2021 Figure 1-1, p. 5

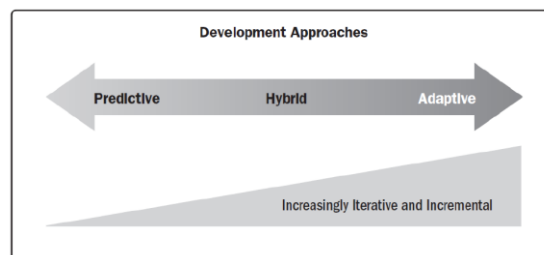
- Stakeholders- This domain focuses on identifying and managing stakeholders to maintain good relationships and meet their expectations. These stakeholders will provide insights into how the virtual lab can enhance student engagement, improve learning outcomes, and increase accessibility.
- Team- This domain emphasizes building and supporting a project team. While this FGP is an individual effort, collaboration with teachers, students, and technical experts is important to refine the virtual lab design.
- Development approach and life cycle- This domain focuses on determining how the project will be structured and managed throughout its lifecycle. The management plan considers different factors such as requirements, constraints, and stakeholder needs to guide the selection of the most suitable approach. Choosing the right approach will ensure the plan is clear, effective, and supports the goal of designing the lab.
- Planning- This domain ensures that the project has clear goals, deliverables, and strategies. Planning also considers budget and technical needs. Planning is essential for defining the scope of the interactive virtual lab design, identifying key requirements, and ensuring the proposed solution is feasible.
- Project work- This domain focuses on coordinating activities to complete the project. For the FGP, project work involves researching best practices, gathering stakeholder input, and documenting the design framework.
- Delivery- This domain ensures that the project meets its goals, scope, and quality requirements. For the FGP, delivery is focused on producing a well-defined management plan that outlines how the virtual lab can be successfully designed.

- **Measurement-** This domain involves tracking progress and ensuring project success. In this FGP, measurement will be done with evaluation criteria and performance indicators. These measures help assess whether the IVSL design meets educational and institutional requirements.
- **Uncertainty-** This domain helps identify and manage risks, challenges, and unknown factors. This FGP considered risks such as technological limitations, adoption challenges, and resource availability. Understanding these uncertainties helped create a more realistic and adaptable project plan.

2.2.3 Predictive, adaptative, and hybrid projects

Projects can follow different development approaches based on their requirements, level of uncertainty, and stakeholder needs. The PMBOK 7th Edition defines three main development approaches: Predictive, Adaptive, and Hybrid (PMI, 2021) as shown in **Figure 4** below. Selecting the appropriate approach helps ensure the project is structured effectively and meets its objectives.

Figure 4. Development Approaches



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK Guide) Seventh Edition*. Project Management Institute (PMI), 2021 Figure 2-7, p. 130

- A predictive approach, also known as the waterfall approach, is used when project requirements are well-defined at the start. This approach follows a structured and sequential process, with clear planning, set milestones, and minimal changes during execution (PMI, 2021). It is commonly used in projects where the scope, schedule, cost, and risks are stable and well understood.
- An adaptive approach, also known as agile, is useful for projects with high uncertainty and evolving requirements (PMI, 2021). This approach allows for incremental development, where work is completed in short cycles. Feedback is continuously integrated to refine the project. Adaptive approaches are flexible, iterative, and responsive to change. This makes them suitable for environments with rapidly changing needs.
- A hybrid approach combines elements from both Predictive and Adaptive approaches. It is useful when some parts of the project require structured planning, while others benefit from flexibility and iterative development (PMI, 2021). This method allows teams to balance stability with adaptability.

A predictive approach is best suited for projects where the requirements are well understood from the beginning and where a detailed plan can be developed and followed throughout the project lifecycle (PMI, 2017). Since this project involves designing an Interactive Virtual Science Laboratory (IVSL) with clearly defined deliverables, cost estimates, and a fixed timeline, a predictive model provides the structure needed to manage scope, schedule, and resources effectively. This approach supports thorough planning, careful documentation, and formal control processes. By following this model, the project

team can ensure that the final product meets academic and technical expectations while aligning with the needs of students, educators, and other key stakeholders.

2.2.4 Project management

According to the PMBOK Guide 7th Edition, a project is a temporary endeavor undertaken to create a unique product, service, or result (PMI, 2021). Project management is an organized process that helps complete projects efficiently while meeting goals and staying within set limits. Below are three widely accepted definitions for project management.

- Project Management Institute (PMI): The PMI defines project management as "the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements" (Project Management Institute, 2021).
- Association for Project Management (APM): The APM describes project management as "the application of processes, methods, skills, knowledge, and experience to achieve specific project objectives according to the project acceptance criteria within agreed parameters" (Association for Project Management, 2019).
- Erik W. Larson and Clifford F. Gray: In their book *Project Management: The Managerial Process* (8th Edition), Erik W. Larson and Clifford F. Gray define project management as "a controlled process of initiating, planning, executing, and closing down a project to achieve specific goals and meet specific success criteria" (Larson & Gray, 2021).

From these definitions it can be said that project management is an organized way to plan, carry out, and complete tasks to achieve specific goals. It involves applying knowledge, skills, and methodologies to ensure projects are completed efficiently and

successfully. Project management follows a structured process from start to finish. This helps organizations achieve their goals while staying within set timelines, budgets, and quality standards.

2.2.5 Project management knowledge areas and processes

Project Management Knowledge areas

A project management knowledge area is a key competency in project management, encompassing a specific set of concepts, processes, and techniques essential for successful project execution (PMI, 2017). In other words, it is a key part of managing a project that helps keep everything organized and on track from start to finish. The PMBOK 6th Edition (PMI, 2017) defines ten knowledge areas. Each area addresses an important aspect of project management. The FGP will apply these knowledge areas to develop a project management plan for designing an interactive virtual science laboratory. This approach ensures that all project elements are effectively managed. The ten knowledge areas include:

- **Project Integration Management-** This knowledge area ensures that all project elements work together cohesively. It focuses on combining and coordinating all aspects of a project to achieve a successful outcome (PMI, 2017). For this FGP, integration management will ensure that all elements of the design of the IVSL work together to create a seamless and functional platform.
- **Project Scope Management-** Scope management ensures that all required work is completed, and that unnecessary work is avoided. (PMI, 2017). It includes defining, validating, and controlling the project's scope to prevent scope creep. The scope management plan ensures that the design of the IVSL remains focused on its

objectives, which will help avoid unnecessary additions that could affect the project schedule and cost.

- **Project Schedule Management-** Schedule management ensures that project tasks are planned, organized, and completed within the required timeframe. It involves defining activities, sequencing them, estimating durations, and monitoring progress to ensure timely project completion (PMI, 2017). A schedule management plan ensures that the design of the IVSL follows a structured timeline. This will include defining key milestones, estimating task durations, and tracking progress to ensure timely completion.
- **Project Cost Management-** Cost management ensures that a project is completed within the approved budget by planning, estimating, and controlling expenses. It helps allocate resources effectively and prevent cost overruns (PMI, 2017). A cost management plan estimates and tracks expenses related to the design of the IVSL. It will ensure that financial resources are allocated efficiently and that the project remains within budget.
- **Project Quality Management-** Quality management ensures that a project meets its objectives by maintaining standards. It involves defining quality requirements, implementing quality assurance measures, and monitoring results to ensure that deliverables meet expectations (PMI, 2017). A quality management plan establishes performance standards for the design of the IVSL. It will ensure that the platform design meets educational and technical requirements and provides engaging and reliable user experience.

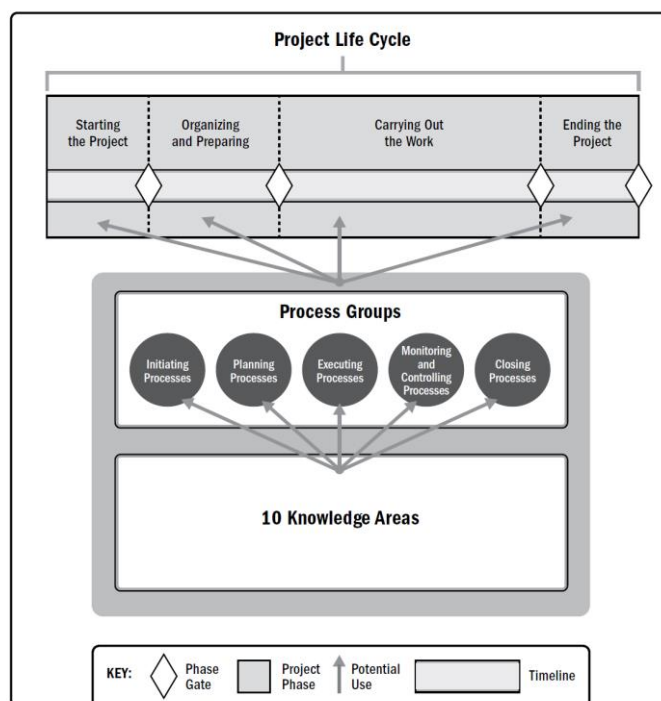
- **Project Resource Management-** Resource management ensures that the necessary personnel, materials, and equipment are available and used efficiently throughout the project. It involves identifying, acquiring, and managing resources to support project success (PMI, 2017). A resource management plan identifies the personnel, tools, and materials needed for the design of the IVSL and allocates them effectively. Proper resource allocation supports the successful completion of the project.
- **Project Communication Management -** Effective communication is essential for project success. Communication management ensures that project information is properly generated, shared, and documented. It involves planning, distributing, and monitoring communications to keep stakeholders informed and engaged (PMI, 2017). A communication management plan facilitates clear communication with stakeholders in the design of the IVSL in a timely fashion. Effective communication will help coordinate efforts and address concerns early on.
- **Project Risk Management-** Risk management ensures that potential issues are identified, analyzed, and addressed before they impact the project. It involves assessing uncertainties, developing response strategies, and monitoring risks to minimize disruptions (PMI, 2017). Depending on whether a risk is a threat or an opportunity, different strategies will be used to either reduce its impact or take advantage of its benefits. By identifying risks early that affect the design of the lab, the project team will be able to take measures and maintain progress toward project goals.

- **Project Procurement Management-** Procurement management ensures that goods and services needed for the project are acquired efficiently. It involves planning purchases, selecting vendors, managing contracts, and overseeing procurement activities (PMI, 2017). A procurement management plan guides the selection and acquisition of software, digital tools, and contracted personnel needed for the design of the IVSL.
- **Project Stakeholder Management-** Stakeholder management ensures that all project stakeholders are properly identified, engaged, and managed. Stakeholders are individuals or groups affected by the project. It involves understanding their needs, keeping them informed, and addressing concerns to maintain support and alignment (PMI, 2017). A stakeholder engagement plan manages interactions with teachers, students, school administrators and technical teams involved in the design of the lab. Maintaining clear communication and addressing stakeholders' expectations will help ensure the design suits their needs.

Project Management Processes

Managing a project requires a structured approach to ensure success. The PMBOK Guide 6th Edition outlines five key process groups as shown in **Figure 5** below. The process groups ensure that projects are well-organized, properly executed, and successfully completed (PMI, 2017).

Figure 5. Project life cycle, process groups, and knowledge areas.



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*, 6th Edition (Project Management Institute, 2017). Figure 1-5, p. 18

Project management processes are grouped into the following five process groups.

- **Initiating** – This phase is the beginning of the project, where the idea is approved and planned at a high level. The project manager is assigned, and key stakeholders are identified. A project charter is created, which formally authorizes the project (PMI, 2017).

- **Planning** – In this phase, a detailed plan is developed to guide the project. This plan includes defining the scope, setting goals, estimating costs, creating a schedule, and identifying risks. A solid plan helps ensure that the project stays on track (PMI, 2017).
- **Executing** – This phase is when the actual work happens. The project team carries out the tasks outlined in the plan, resources are managed, and communication with stakeholders is maintained. The goal is to complete the work as planned while ensuring quality (PMI, 2017).
- **Monitoring and Controlling** – This phase runs alongside execution to track progress and make adjustments if needed. The project manager checks if the project is meeting its goals, controls costs, and manages risks to keep the project on course (PMI, 2017).
- **Closing** – The final stage is where the project is completed, and the final product or result is delivered. A review is done to assess what went well and what could be improved for future projects. The project is then formally closed (PMI, 2017).

The PMBOK Guide 6th Edition organizes 49 project management processes into five process groups and ten knowledge areas to provide a structured framework for managing projects effectively. **Figure 6** below illustrates how these processes are mapped across different knowledge areas and process groups. This ensures a comprehensive approach to project planning and execution.

Figure 6. Project management process groups and knowledge area mapping.

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work 4.4 Manage Project Knowledge	4.5 Monitor and Control Project Work 4.6 Perform Integrated Change Control	4.7 Close Project or Phase
5. Project Scope Management		5.1 Plan Scope Management 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS		5.5 Validate Scope 5.6 Control Scope	
6. Project Schedule Management		6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Durations 6.5 Develop Schedule		6.6 Control Schedule	
7. Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
8. Project Quality Management		8.1 Plan Quality Management	8.2 Manage Quality	8.3 Control Quality	
9. Project Resource Management		9.1 Plan Resource Management 9.2 Estimate Activity Resources	9.3 Acquire Resources 9.4 Develop Team 9.5 Manage Team	9.6 Control Resources	
10. Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Monitor Communications	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses	11.6 Implement Risk Responses	11.7 Monitor Risks	
12. Project Procurement Management		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	
13. Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Engagement	13.3 Manage Stakeholder Engagement	13.4 Monitor Stakeholder Engagement	

Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*, 6th Edition (Project Management Institute, 2017). Table 1-4, p. 25

2.2.6 Project life cycle

Project management involves various life cycles to execute and deliver projects efficiently.

The project life cycle as seen in **Figure 7** represents the structured stages a project follows from initiation to closure, regardless of the approach used.

Figure 7. Phase of a project lifecycle

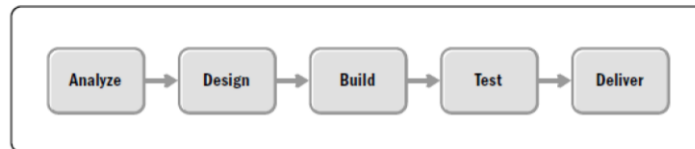


Note. Adapted from *Project Lifecycle Management (PrLM): A Comprehensive Guide* (Jama Software, 2023), retrieved from <https://www.jamasoftware.com/blog/blog-project-lifecycle-management-prlm-a-comprehensive-guide/>.

The PMBOK Guide 6th Edition outlines different types of project life cycles which include predictive, iterative, incremental, adaptive, and hybrid (PMI, 2017). Each type of lifecycle is suited for specific project characteristics.

- A predictive life cycle follows a step-by-step process, as shown in **Figure 8** below. The project's scope, time, and cost are known at the start. This approach works best for projects with clear requirements and little chance of change.

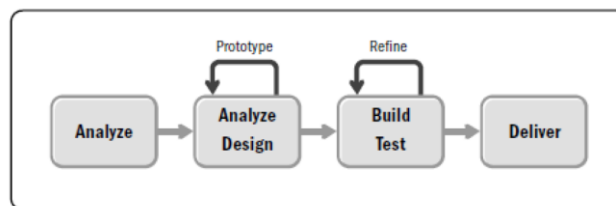
Figure 8. Predictive Life Cycle Phases



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK Guide), 6th Edition*. (Project Management Institute, 2017, p. 792).

- An iterative life cycle repeats project phases. In this way gradual improvements are made based on feedback. Unlike a predictive model, it expects changes and adjusts as new ideas develop. This approach is useful for projects that need frequent reviews, like research or software development (Kerzner, 2022). **Figure 9** below illustrates this concept.

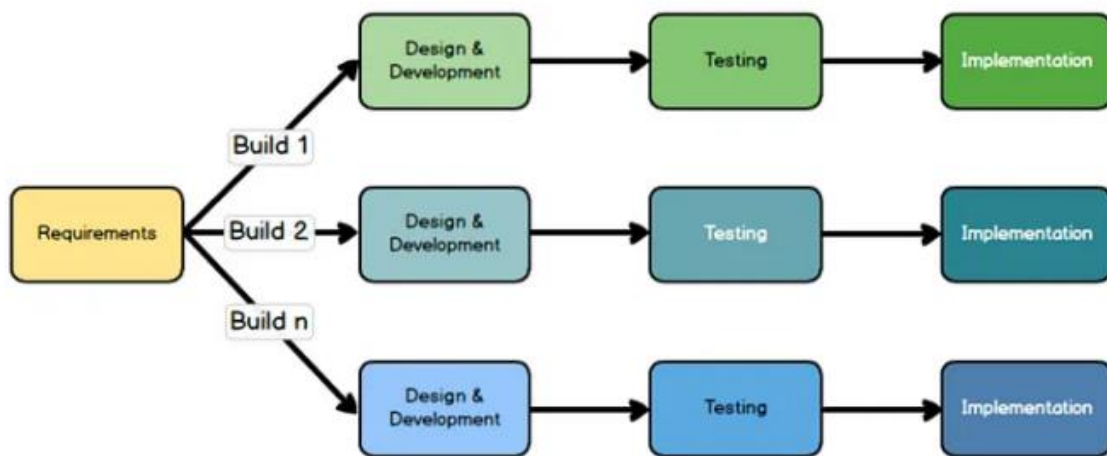
Figure 9. Iterative Life Cycle Phases



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 6th Edition* (Project Management Institute, 2017, p. 792).

- An incremental life cycle delivers the project in small parts, allowing stakeholders to see progress at each stage. Each phase adds new features. The final product is only complete after several iterations. This approach is often used in product development when early usability is important (Lock, 2020). **Figure 10** below shows this process.

Figure 10. Incremental Life Cycle Phase

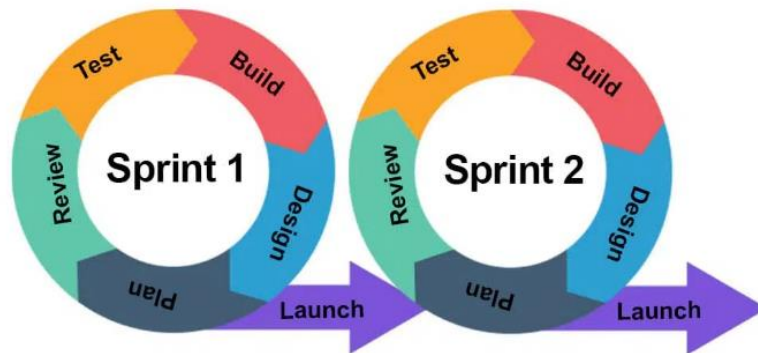


Note. Adapted from "DLC Software Development Model: Incremental Development," (Design Bootcamp, 2021) retrieved from <https://medium.com/design-bootcamp/dlc-software-development-model-incremental-development-7598ae6500e6>.

- An adaptive life cycle is highly flexible and allows for frequent changes. Projects are completed in short cycles known as sprints. There is ongoing input from stakeholders and adjustments are made as needs evolve (PMI, 2017).

Figure 11 below illustrates this process.

Figure 11. Adaptive Life Cycle Phases



Note. Adapted from *"What is the Project Life Cycle?"* (F. Usmani, 2024) PM Study Circle, retrieved from <https://pmstudycircle.com/project-life-cycle/>.

- A hybrid life cycle blends both predictive and adaptive approaches. Some parts of the project follow a fixed plan, while others remain flexible and change based on feedback. This model is useful for complex projects with both stable and evolving elements (Kerzner, 2022).

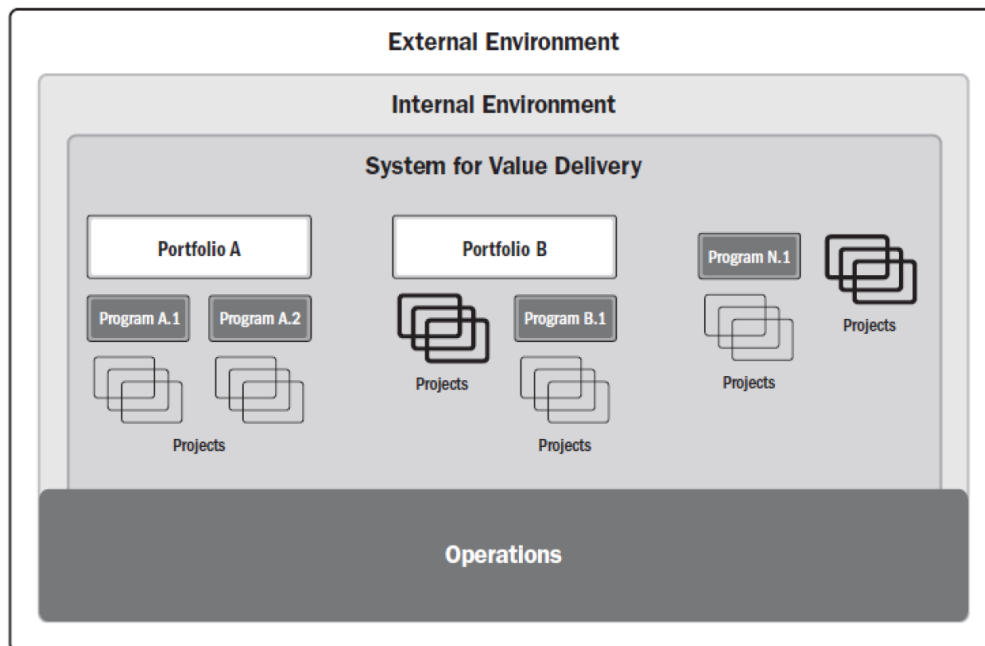
The most suitable project life cycle for the design of the IVSL project is an adaptive life cycle. This project requires flexibility to accommodate evolving requirements and stakeholder feedback which are very important to the design. The key deliverables, scope, and timelines may change as adjustments are made. Using an adaptive life cycle allows for continuous testing and improvement. An adaptive life cycle is ideal for projects like this one since ongoing feedback from educators and students helps shape the final design to better meet their learning needs.

2.2.7 Company strategy, portfolios, programs and projects

A company's strategy sets its long-term goals and direction. It helps the company stay competitive, use resources efficiently, and create value. The strategy connects the company's mission and vision to its daily operations (OrgVue, 2023) and ensures steady growth and the ability to adapt to changing market conditions (Businessmap, 2023).

Catalyst Education Services' strategy focuses on using technology to enhance educational accessibility and efficiency. Organizations manage their strategic objectives through portfolios, programs, and projects. **Figure 12** shows how portfolios, programs, and projects work together within a system to deliver value and support the company's strategic goals.

Figure 12. Components of a System for Value Delivery



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*, 7th Edition (Project Management Institute, 2021) p. 37.

A portfolio is a group of programs and projects that work together to support a company's long-term goals (PMI, 2021). As Catalyst Educational Services expands its services, it could develop a Digital Education Innovation Portfolio that includes various digital learning solutions aimed at improving accessibility and engagement in education. Within this portfolio, a Science and Math Digital Learning Program could be established to manage projects specifically focused on science and math education. A program includes related projects managed together to achieve benefits not available from managing them individually (PMI, 2017). The design of the Interactive Virtual Science Lab would be one of the key projects in this program. Other potential projects in this program can include the design and development of interactive Math and quantitative Chemistry simulations.

A project is a temporary effort undertaken to create a unique product, service, or result (PMI, 2017). At the moment, the design of the Interactive Virtual Science Lab is a standalone pilot project that is helping Catalyst Educational Services move from independent professional services toward digital learning solutions. This pioneer project contributes to the company's broader goals by designing an engaging learning environment.

2.3 Other applicable theory/concepts related to the project topic and context

2.3.1 Current situation of the problem or opportunity in study

Most science courses have a laboratory component because students learn better by conducting experiments. Laboratory experiments allow students to apply theoretical knowledge and see science in action. Traditional laboratories are done in person and require designated spaces, supplies, equipment, laboratory technicians, and instructors. Traditional laboratories are a challenge for online students and also expensive for institutions to run. In these labs, students conduct experiments within a time frame and then prepare lab reports to

document and analyze their findings. Some institutions still use physical lab books for lab reports while others accept digital submissions. These reports create a heavy workload for instructors who are tasked with grading hundreds of reports per semester. It reduces the amount of time instructors can spend assisting students and preparing course content.

Another major limitation of traditional labs is that they do not allow for multiple attempts at experiments. Due to limited time and cost of materials, students often feel pressured to complete experiments without any mistakes. This pressure can lead to increased stress and anxiety which reduces their ability to focus on learning. Virtual laboratories offer a possible solution by allowing students to repeat experiments as many times as needed without additional costs or wasted materials (Sellberg, Nazari, & Solberg, 2024). The design of the interactive virtual laboratory will allow students to conduct experiments using simulations. These simulations differ from other virtual lab solutions which require Virtual Reality (VR) headsets or additional software.

Some educational institutions have experimented with hybrid learning models. In this model, some students conduct experiments online while others conduct the lab in person. The online cohort of students receive a video demonstration of the experiment performed by the laboratory technician. The students can watch and take notes. This method was commonly used during the COVID-19 pandemic when institutions had to quickly adapt to remote learning (Beyond the Classroom Walls, 2023). While this reduces some costs, it does not fully engage the online cohort of students. Watching a recorded video of an experiment does not provide the same interactive experience as conducting the experiment and manipulating variables yourself. This model also does not reduce the time spent by instructors grading lab reports.

Another approach involves using independent virtual lab software. Some educational institutions have tried free virtual lab software, but these often do not integrate with Learning Management Systems (LMS) such as Moodle. A lack of LMS integration makes it difficult for instructors to track student progress and assessments. Without this integration, instructors must manually transfer student scores from the lab software into the LMS, leaving room for human error. Additionally, many of the free virtual lab software available are not aligned with the course content of institutions.

The Interactive Virtual Science Laboratory (IVSL) is designed to address these challenges by providing engaging simulations that students can access without needing a VR headset or additional software. IVSL will provide students with interactive virtual experiments where they can manipulate variables, observe changes, and analyze results. The IVSL will be designed to integrate with LMS commonly used in Belize such as Moodle. This integration ensures that student progress is tracked, and assessments are automatically graded. The IVSL design will be cost-effective and will increase access to lab experience for students in online programs and those with limited resources. Instructors will also benefit from automated assessments which will give them time to focus more on lesson preparation, teaching, and assisting students. By addressing the inefficiencies mentioned, IVSL aims to enhance science education for both students and educators.

2.3.2 Previous research done for the topic in the study

Based on the preliminary research done, virtual laboratories have been widely studied as an alternative to traditional labs in science education. Research has shown that virtual labs help improve learning and engagement by being self-paced and including interactive simulations. A study on chemistry students found that those who used virtual

labs performed better on assessments than those who relied only on traditional instruction (Bazie & Lemma, 2024). This finding suggests that virtual experiments allow students to better comprehend scientific concepts versus lectures alone. Additionally, virtual labs offer flexibility as students can access and repeat experiments as needed. Research indicates that virtual labs help students work at their own pace, reducing stress and improving their overall learning experience (Beyond the Classroom Walls, 2023). A case study on virtual physics labs showed that students using simulations scored 20-30% higher on assessments compared to those in traditional labs (Development and Implementation of Virtual Physics Laboratory, 2023). This result demonstrates that virtual learning can be just as effective in-person instruction.

One of the most significant advantages of virtual labs is providing access for students who cannot attend physical labs. Virtual labs are an economical and sustainable alternative to physical labs. Many educational institutions have a difficult time maintaining laboratories with updated technology, materials and supplies. This budget constraint is also felt by the students who incur increased lab fees to maintain the laboratories. Virtual labs help to cut costs by eliminating the need for chemicals, glassware, and specialized equipment. A study from Nankai University found that implementing virtual labs significantly reduces institutional costs, making them a practical solution for universities and schools with limited resources (Design and Implementation of Virtual Laboratories for Higher Education Sustainability, 2022). The initial investment in design, development, and implementation would be substantial, but it would lead to cost savings over the long term. This project would be assisting institutions by designing the IVSL. Additionally, virtual labs promote environmental sustainability by reducing waste from lab materials (Formative, 2020).

Another important feature of virtual labs is the improved types of assessments. Traditional lab courses require instructors to spend hours grading lab reports manually. Most times instructors are behind in grading and therefore students receive delayed feedback, which makes it difficult for students to improve. McGraw Hill (2022) explains that virtual labs can include interactive evaluations such as pre-lab assignments and post-lab quizzes. These provide instant feedback to students and help instructors save time on grading. McGraw Hill (2022) also states that these assessment tools allow instructors to monitor student progress and adjust teaching strategies as needed. Additionally, to improve engagement, it is essential to design virtual labs that are interactive and easy to use. The webinar by Formative (2020) offers insights into how virtual labs can be made more engaging through features such as interactive animations and real-time simulations. These elements help keep students motivated and involved rather than watching instructional videos.

This preliminary research has provided valuable information to consider for the design of the Interactive Virtual Science Laboratory (IVSL). A project management plan for designing an interactive virtual science laboratory will be produced with this information in mind. By following best practices from existing virtual lab models, the IVSL will be designed to enhance online science education while addressing the challenges of traditional labs.

2.3.3 Other theories related to the topic in the study

Constructivist Learning Theory

Constructivist Learning Theory was developed by educational psychologists Jean Piaget (1972) and Lev Vygotsky (1978). This theory suggests students learn best by actively exploring and making sense of their experiences. Piaget emphasized learning through hands-on discovery and personal experience rather than memorizing information. He believed that students gain deeper knowledge when they directly engage with activities and then reflect on what they have learned (Piaget, 1972). Constructivism highlights the importance of giving students experiences where they can explore, experiment, and understand. Feedback from instructors is also essential because it helps students reflect and improve (Piaget, 1972). This approach is quite different from traditional methods where students often receive information without exploring it themselves.

The Interactive Virtual Science Laboratory (IVSL) applies constructivist principles by giving students an environment to perform science experiments virtually. In this online environment, students can actively test scientific concepts by simulating experiments and controlling variables on their own. Rather than just watching someone else do the experiment, they get to directly see what happens when they make changes. Since the lab is virtual, students can repeat the experiment as many times as they like. They do not have to worry about making mistakes or using too much of the lab materials. This freedom to experiment multiple times gives students the time they may need to better understand the concepts they are learning. This scenario aligns with Piaget's (1972) idea of active learning through personal experience and allows each student to learn at their own rate.

Another important part of constructivist learning is reflecting on experiences to build deeper understanding (Piaget, 1972). To support this, the IVSL design includes assessments for students to work on before and after the experiment. They get an opportunity to analyze their results and make connections to the theory they have learned. Immediate feedback is provided on these assessments identifying what students did correctly or incorrectly. This prompt feedback helps students clearly understand their mistakes and learn from them. Over time, the students' understanding of scientific concepts will improve, and they will gain confidence in the subject matter.

Cognitive Load Theory

Cognitive Load Theory was developed by educational psychologist John Sweller (1988). This theory explains that students have a limited capacity in their working memory. According to Sweller, students can only handle a small amount of new information at any given time. If students are given too much information at once, their minds become overloaded. This overload can make them feel confused and overwhelmed which causes frustration and difficulty learning (Sweller, 1988). To prevent cognitive overload, Sweller suggests breaking complicated information into smaller, simpler parts that are easy for students to manage (Sweller, van Merriënboer, & Paas, 1998). Teaching materials should clearly highlight what is important without adding unnecessary complexity. When content is clearly structured, students can easily process new ideas and learn more effectively.

The IVSL is designed with these ideas in mind. Each virtual experiment is organized into small, straightforward steps which reduces the load on their working memory. This clear and simple organization ensures that students understand what to do at

every stage and avoids confusion. The IVSL is designed to provide feedback after each step therefore students quickly understand if they have misunderstood a concept.

The project management plan for designing the IVSL outlines that experiment instructions will use simple language, clear visuals, and logical sequences, which helps students to easily follow along. With ongoing reviews by students and teachers, the design team will quickly spot and fix any areas that are unclear or may create confusion. By incorporating these strategies into the project management plan, the will IVSL design helps students learn comfortably without feeling overwhelmed.

Technology Acceptance Model

The Technology Acceptance Model was developed by Fred Davis (1989). According to Davis, people are more likely to use new technology if it is perceived as useful and easy to operate. Perceived usefulness means users see clear benefits from using the technology. Perceived ease of use means users think the technology is simple and does not require much effort to learn (Davis, 1989). If the technology feels difficult to use or does not clearly show its value, users are less likely to accept or regularly use it (Davis, Bagozzi, & Warshaw, 1989).

Applying this theory to the IVSL means the lab must be designed in a way that is very simple to understand. The design will use clear layouts and navigation to help students quickly find what they need. The project management plan includes creating clear instructions for each part of the lab. This inclusion ensures students know exactly how to start, perform, and finish each experiment without confusion. Instead of complicated interfaces, the design will use visuals with clear labels. By doing this, students can quickly

understand how to use the lab without frustration, allowing them to focus on learning the concepts.

Additionally, the IVSL's design will clearly demonstrate educational benefits such as being able to repeat experiments and receive instant feedback. These features clearly show students and instructors why the virtual lab is useful. During the design phase, the project management plan will include regular reviews to ensure students and instructors find the lab easy to use and helpful. Feedback gathered during the design process will guide improvements to make sure the IVSL remains simple and valuable to its users. By consistently reviewing the design, the IVSL will effectively meet the conditions and encourage students and teachers to accept, use and appreciate the value of the platform.

In conclusion, the design of the Interactive Virtual Science Laboratory (IVSL) is also guided by these three theories. Constructivist Learning Theory, developed by Piaget (1972) and Vygotsky (1978), suggests that students learn best by actively experimenting and reflecting on their experiences. IVSL design supports this by giving students opportunities to actively perform virtual experiments and receive feedback. Cognitive Load Theory, introduced by Sweller (1988), recommends breaking complicated tasks into simpler steps to avoid overwhelming students. IVSL design follows this advice by organizing experiments into clear manageable stages to reduce confusion. Lastly, the Technology Acceptance Model by Davis (1989) emphasizes that new technologies must be deemed easy to use and clearly beneficial. The design must be user-friendly with simple instructions and immediate feedback on assessments, which helps students and teachers recognize its value. By considering these theories, the project management plan ensures an effective design that improves student learning and acceptance of the new technology.

3 METHODOLOGICAL FRAMEWORK

The methodological framework outlines the structured approach used to develop a Project Management Plan for Designing an Interactive Virtual Science Laboratory. This framework identifies the information sources, research methods, tools, assumptions, constraints, and deliverables essential to achieving the project's objectives. Clearly defining these elements helps keep the project consistent. It also ensures the project meets its goals by effectively responding to what stakeholders need and fulfilling project requirements. This approach follows the standards set by the Project Management Institute (PMI, 2021).

3.1 Information sources

Information sources are materials or references such as books, journal articles, reports, websites, and interviews that researchers use to gather facts and support their studies. According to Creswell and Creswell (2018), information sources help researchers clearly understand the topic, support arguments, and demonstrate the significance of their research. Saunders, Lewis, and Thornhill (2019) similarly highlight the importance of using trustworthy information sources to ensure the credibility and reliability of the research and to identify areas needing further exploration. For this Final Graduation Project, credible primary sources and secondary sources will be carefully selected and analyzed to develop an effective Project Management Plan for Designing an Interactive Virtual Science Laboratory.

3.1.1 Primary sources

Primary sources are original records or firsthand evidence about an event, person, or object, provided without interpretation or commentary from other authors (University of Massachusetts Boston Library, 2023). These sources are created by individuals who

directly experienced events or participated in original research. They include interviews, surveys, theses, dissertations, original documents, artifacts, and first-person accounts (University of Minnesota Crookston, 2022). For this Final Graduation Project, structured interviews and surveys conducted with teachers, students, and administrators are key primary sources. Additionally, subject matter experts in Information Technology (IT) will be consulted to gather firsthand knowledge and best practices for the design of the virtual laboratory. These primary sources are important as they directly provide insights such as existing challenges, expectations, and requirements. They ensure that the Interactive Virtual Science Laboratory design meets educational and technological requirements.

3.1.2 Secondary sources

Secondary sources analyze, interpret, or summarize information originally presented in primary sources, providing further explanation or additional insights (University of Minnesota Crookston, 2022). They summarize or clarify primary data to help readers understand it better. Common examples of secondary sources include textbooks, journal articles, books, literature reviews, and industry reports (University of Massachusetts Boston Library, 2023). This Final Graduation Project uses several secondary sources. The PMBOK® Guide 6th edition (PMI, 2017) is the main reference for the methods and processes used. The PMBOK® Guide 7th edition (PMI, 2021) is also used to complement and provide updated information. Other secondary sources include textbooks on educational technology and journal articles about virtual science labs and digital learning. These secondary sources provide useful background information and best practices. They help guide the planning and design of the Interactive Virtual Science Laboratory.

Table 1 below summarizes the primary and secondary information sources that were selected for this FGP research.

Table 1. Information Sources

Objectives	Information sources	
	Primary	Secondary
1. To create a Project Charter that formally authorizes the project and establishes its purpose and objectives.	Interviews with educators, administrators, and meeting with the project sponsor.	PMBOK® Guide (6th & 7th ed.), textbooks, and scholarly articles about project initiation and charters
2. To create a Scope Management Plan to define the project's scope, requirements, and deliverables.	Surveys and structured interviews with educators and students; focus group meetings.	PMBOK® Guide (6th & 7th ed.), textbooks, scholarly articles on scope definition and requirements management.
3. To create a Schedule Management Plan to outline the project timeline and key milestones for the design of the interactive virtual science laboratory.	Interviews with educators, administrators, and IT experts	PMBOK® Guide (6th & 7th ed.), textbooks, scholarly articles on schedule management and timelines.
4. To create a Cost Management Plan to develop cost estimates and establish the budget for the design of the interactive virtual science laboratory.	Interviews and consultations with administrators, educators, and financial experts.	PMBOK® Guide (6th & 7th ed.), textbooks, scholarly articles on budgeting and cost management.
5. To create a Quality Management Plan to define quality standards and ensure the design meets educational and technological requirements.	Surveys and interviews with educators and students and focus group meetings.	PMBOK® Guide (6th & 7th ed.), textbooks, and journal articles on quality management in education.
6. To create a Resource Management Plan to determine and allocate the resources needed for the	Interviews with educators, administrators, and technical specialists.	PMBOK® Guide (6th & 7th ed.), textbooks, and journal articles on resource management and allocation

Objectives	Information sources	
	Primary	Secondary
design of the interactive virtual science laboratory.		
7. To create a Communication Management Plan to establish how project information will be shared, ensuring clear and effective communication among stakeholders.	Surveys, interviews with educators and administrators, and focus group meetings.	PMBOK® Guide (6th & 7th ed.), textbooks, and scholarly articles on project communication
8. To create a Risk Management Plan to identify potential risks, assess their impact, and develop strategies to manage them.	Consultations with educators and IT experts; stakeholder surveys and focus group meetings.	PMBOK® Guide (6th & 7th ed.), textbooks, and scholarly articles on risk management.
9. To create a Procurement Management Plan to define the process for acquiring external resources and services required.	Interviews with administrators and IT experts, consultation with project sponsor.	PMBOK® Guide (6th & 7th ed.), textbooks, and articles on procurement and vendor selection.
10. To create a Stakeholder Engagement Plan to identify key stakeholders and define how they will be engaged throughout the project.	Surveys, interviews, and meetings with educators, students, administrators, and IT specialists.	PMBOK® Guide (6th & 7th ed.), textbooks, and articles on stakeholder management.

Note. Own work.

3.2 Research methods

Research methods are organized steps used to gather and study information to answer specific research questions. They guide researchers in structuring investigations to ensure accuracy and validity in findings (Scribbr, 2023). Sreekumar (2023) explains that research methodology encompasses the techniques and procedures used to identify and analyze information regarding a specific research topic. The choice of research methods

depends on the study's objectives and the type of data needed. For this Final Graduation Project (FGP), several research methods were applied including the analytic-synthetic, inductive-deductive, and statistical method. Each of these methods is described below along with its application to this research.

3.2.1 Analytic-Synthetic Method

The analytic-synthetic method has two steps: analysis and synthesis. Analysis means breaking down complicated information into simpler parts to study them closely. Synthesis means putting these parts back together to form a clear and complete understanding. This method is useful for understanding how different components interact within a system (Masaryk University, 2023). In this FGP, the analytic-synthetic method is used to examine current virtual science labs, break down their main features, and combine the findings to develop an improved project management plan.

3.2.2 Inductive-Deductive Method

The inductive-deductive method combines two ways of reasoning. Inductive reasoning starts with specific observations and moves toward general conclusions. Deductive reasoning begins with general ideas or theories and then applies them to specific situations. This dual approach enables researchers to refine theories based on real-world evidence (Scribbr, 2023). In this FGP, the inductive approach is used to look closely at survey answers and feedback from stakeholders to find important patterns or themes. Then, the deductive approach uses project management frameworks to check these themes and help create the project plan.

3.2.3 Statistical Method

The statistical method involves gathering, studying, and understanding numerical data to find patterns and help make decisions. (Scribbr, 2023). In this FGP, statistical analysis is used to process survey data and evaluate stakeholder feedback regarding virtual laboratory design and effectiveness. **Table 2** below summarizes the research methods selected for this FGP research.

Table 2. Research methods

Objectives	Research methods		
	Analytic-Synthetic	Inductive-Deductive	Statistical
1. To create a Project Charter that formally authorizes the project and establishes its purpose and objectives.		Reviewed various project charters and ensured alignment with project management standards.	
2. To create a Scope Management Plan to define the project's scope, requirements, and deliverables.	Broke down project requirements into smaller components, analyzed each one, and synthesized them into a structured scope plan		
3. To create a Schedule Management Plan to outline the project timeline and key milestones for the design of the interactive virtual science laboratory.			Used past project timelines and scheduling data to estimate task durations and develop an optimized schedule.
4. To create a Cost Management Plan to develop cost estimates and establish the budget for the design of			Analyzed cost estimates from similar projects to develop an

Objectives	Research methods		
	Analytic-Synthetic	Inductive-Deductive	Statistical
the interactive virtual science laboratory.			accurate budget forecast.
5. To create a Quality Management Plan to define quality standards and ensure the design meets educational and technological requirements		Used survey responses and stakeholder feedback to determine key quality standards and tested them against established benchmarks.	
6. To create a Resource Management Plan to determine and allocate the resources needed for the design of the interactive virtual science laboratory.	Identified the necessary resources, analyzed them separately, and combined them into a structured resource plan.		
7. To create a Communication Management Plan to establish how project information will be shared, ensuring clear and effective communication among stakeholders.		Developed a communication plan based on stakeholder input, industry best practices, and internal project needs.	
8. To create a Risk Management Plan to identify potential risks, assess their impact, and develop strategies to manage them			Used probability analysis to assess the likelihood and impact of potential risks, helping to develop mitigation strategies.
9. To create a Procurement Management Plan to define the process for acquiring external resources and services required.	Reviewed different procurement strategies, analyzed them, and structured them into a clear purchasing and vendor management plan.		

Objectives	Research methods		
	Analytic-Synthetic	Inductive-Deductive	Statistical
10. To create a Stakeholder Engagement Plan to identify key stakeholders and define how they will be engaged throughout the project.		Identified key stakeholders, gathered their input through surveys and discussions, and developed engagement strategies based on their needs	

Note. Own work.

3.3 Tools

Tools in project management are techniques, software, or methodologies that help in planning, executing, and controlling project activities effectively (PMI, 2021). These tools help organize project information, improve communication, manage risks, and make sure project goals are met effectively. (Meredith, Shafer, Mantel, & Sutton, 2020). The selection of tools depends on the project's objectives and complexity.

For this Final Graduation Project (FGP), tools were selected from the PMBOK® Guide 6th and 7th editions (PMI, 2017; 2021). These tools are important for organizing the Project Management Plan. They help keep things consistent in areas such as scope, schedule, budget, risk management, stakeholder engagement, and quality control. Using standardized tools ensures alignment with best practices. **Table 3** below summarizes the tools selected for this FGP research.

Table 3. Tools

Objectives	Tools
1. To create a Project Charter that formally authorizes the project and establishes its purpose and objectives.	• Project Charter Template • Expert Judgment • Data Gathering • Stakeholder Analysis
2. To create a Scope Management Plan to define the project's scope, requirements, and deliverables.	• Scope Management Plan Template • Scope Statement • Work Breakdown Structure (WBS) • Requirement Documentation • Requirements Traceability Matrix, • Decomposition
3. To create a Schedule Management Plan to outline the project timeline and key milestones for the design of the interactive virtual science laboratory.	• Schedule Management Plan Template • Gantt Chart • Critical Path Method (CPM) • Milestone Chart • Microsoft Project
4. To create a Cost Management Plan to develop cost estimates and establish the budget for the design of the interactive virtual science laboratory.	• Cost Management Plan Template • Cost Estimation Techniques (Bottom-Up Estimating, Parametric Estimating) • Earned Value Management (EVM) • Cost- Benefit Analysis • Reserve Analysis
5. To create a Quality Management Plan to define quality standards and ensure the design meets educational and technological requirements	• Quality Management Plan Template • Quality Metrics • Benchmarking
6. To create a Resource Management Plan to determine and allocate the resources needed for the design of the interactive virtual science laboratory.	• Resource Management Plan Template • Resource Breakdown Structure (RBS) • RACI Matrix • Organizational Breakdown Structure (OBS)
7. To create a Communication Management Plan to establish how project information will be shared, ensuring clear and effective communication among stakeholders.	• Communication Management Plan Template • Communication Matrix • Communication Escalation Matrix
8. To create a Risk Management Plan to identify potential risks, assess their impact, and develop strategies to manage them	• Risk Management Plan Template • Risk Register • Probability and Impact Matrix • Risk Categorization

Objectives	Tools
9. To create a Procurement Management Plan to define the process for acquiring external resources and services required.	• Procurement Management Plan Template • Contract Types • Source Selection Criteria
10. To create a Stakeholder Engagement Plan to identify key stakeholders and define how they will be engaged throughout the project.	• Stakeholder Engagement Plan Template • Stakeholder Register • Power-Interest Matrix • Engagement Assessment Matrix

Note. Own work.

3.4 Assumptions and constraints

Assumptions and constraints are important factors that affect how a project is planned and carried out. According to the Project Management Institute (PMI), an assumption is something assumed to be true but not proven, while a constraint is a limitation that impacts how a project is done, such as time, cost, or resources. (PMI, 2017). Assumptions help set expectations, while constraints define the project's limits.

In this Final Graduation Project (FGP), assumptions include stakeholder participation, availability of data, and access to software. Constraints, on the other hand, include budget limitations, time constraints, and the absence of similar projects in Belize for direct comparison. Recognizing these factors early helps identify and manage possible risks throughout the project's lifecycle. **Table 4** summarizes the assumptions and constraints that were applicable to each specific objective under this FGP research.

Table 4. Assumptions and constraints

Objectives	Assumptions	Constraints
1. To create a Project Charter that formally authorizes the project and establishes its purpose and objectives.	It is assumed that key stakeholders will participate and provide the necessary input.	Limited time and resources to complete the FGP within the assigned timeframe.
2. To create a Scope Management Plan to define the project's scope, requirements, and deliverables.	It is assumed that the scope can be clearly defined with minimal changes after feedback.	Few case studies exist on virtual science labs in Belize or the region, making comparisons harder.
3. To create a Schedule Management Plan to outline the project timeline and key milestones for the design of the interactive virtual science laboratory.	It is assumed that project management software and scheduling tools will be available, and that tasks and milestones can be accurately estimated.	Availability of interviewees or participants may delay some scheduled activities.
4. To create a Cost Management Plan to develop cost estimates and establish the budget for the design of the interactive virtual science laboratory.	It is assumed that data for estimating virtual lab design costs is available online.	Limited access to current financial data from similar virtual education projects in the country.
5. To create a Quality Management Plan to define quality standards and ensure the design meets educational and technological requirements	It is assumed that education and IT quality standards are available online.	Some quality standards may require adaptation to a virtual environment.
6. To create a Resource Management Plan to determine and allocate the resources needed for the design of the interactive virtual science laboratory.	It is assumed that information about required resources will be accessible.	Some experts may have limited availability to provide input. Limited technical resources or access to software during the FGP research process.
7. To create a Communication Management Plan to establish how project information will be shared, ensuring clear and effective communication among stakeholders.	It is assumed that stakeholders will respond to surveys or interviews in a timely manner.	Limited time and potential lack of engagement from participants may affect communication planning
8. To create a Risk Management Plan to identify potential risks, assess their	It is assumed that major risks in virtual learning	The unpredictability of stakeholder availability

Objectives	Assumptions	Constraints
impact, and develop strategies to manage them	design can be identified early.	or digital access may present unknown risks.
9. To create a Procurement Management Plan to define the process for acquiring external resources and services required.	It is assumed that information on software or service vendors is accessible for planning.	There may be limited availability of suitable local or regional vendors offering virtual lab-related tools or services.
10. To create a Stakeholder Engagement Plan to identify key stakeholders and define how they will be engaged throughout the project.	It is assumed that key stakeholders will be willing to share their needs and feedback.	Different priorities among stakeholders may cause challenges.

Note. Own work.

3.5 Deliverables

Deliverables are the key outputs or results a project must produce. The PMBOK® Guide defines a deliverable as "any unique and verifiable product, result, or capability to perform a service that is required to be produced" (PMI, 2017). Deliverables help show that project objectives have been met and are important for measuring success. According to Kissflow (2022), deliverables can be internal, external, or planning-related, depending on the project type. The deliverables for this FGP included the specific outputs under each specific objective. **Table 5** below summarizes the deliverables for this FGP.

Table 5. Deliverables

Objectives	Deliverables
1. To create a Project Charter that formally authorizes the project and establishes its purpose and objectives.	Project Charter- includes the project purpose, objectives, high-level requirements, assumptions, and stakeholder identification.
2. To create a Scope Management Plan to define the project's scope, requirements, and deliverables.	Scope Management Plan- includes the Scope Statement, Work Breakdown Structure (WBS), WBS Dictionary, and Requirements Traceability Matrix.
3. To create a Schedule Management Plan to outline the project timeline and key milestones for the design of the interactive virtual science laboratory.	Schedule Management Plan- includes the project schedule, activity list, milestone list, schedule baseline, and control methods.
4. To create a Cost Management Plan to develop cost estimates and establish the budget for the design of the interactive virtual science laboratory.	Cost Management Plan- includes cost estimation methods, cost baseline, and budget control processes.
5. To create a Quality Management Plan to define quality standards and ensure the design meets educational and technological requirements	Quality Management Plan- includes quality objectives, quality control measures, and continuous improvement guidelines.
6. To create a Resource Management Plan to determine and allocate the resources needed for the design of the interactive virtual science laboratory.	Resource Management Plan- includes the Resource Breakdown Structure (RBS), team assignments, and resource allocation strategies.
7. To create a Communication Management Plan to establish how project information will be shared, ensuring clear and effective communication among stakeholders.	Communication Management Plan- includes the communication matrix, stakeholder communication needs, and reporting requirements.
8. To create a Risk Management Plan to identify potential risks, assess their impact, and develop strategies to manage them	Risk Management Plan- includes the Risk Register, Probability and Impact Matrix, and Risk Response Strategies.
9. To create a Procurement Management Plan to define the process for acquiring external resources and services required.	Procurement Management Plan- includes procurement methods, contract types, and vendor selection criteria.
10. To create a Stakeholder Engagement Plan to identify key stakeholders and define how they will be engaged throughout the project.	Stakeholder Engagement Plan- includes the stakeholder register, stakeholder influence assessment, and engagement strategies.

Note. Own work.

4 RESULTS

4.1 Project Charter

The Project Charter serves as the foundational document that authorizes the Interactive Virtual Science Laboratory (IVSL) project. It outlines the project's purpose, objectives, key stakeholders, high-level requirements, assumptions, constraints, and an overview of the project's scope. The Project Charter is presented below in **Table 6**.

Table 6. Project Charter

PROJECT CHARTER	
DATE	PROJECT NAME
02/18/2025	Design of an Interactive Virtual Science Laboratory for Catalyst Educational Services
PROJECT LIFE CYCLE	Predictive
KNOWLEDGE AREA / PROCESS GROUP	Application area (Sector / Activity)
Processes: • Initiating • Planning Knowledge Areas: • Integration Management • Scope Management • Schedule Management • Cost Management • Quality Management • Resource Management • Communications Management • Risk Management • Procurement Management • Stakeholder Management	Education / Educational Technology

Tentative start date	Tentative completion date	Duration (months)
07/01/2025	12/31/2025	6 months
Project objectives (general and specific)		
General objective: To design an Interactive Virtual Science Laboratory that enhances accessibility, engagement, and learning outcomes for science students in Belize through the use of digital simulations and automated assessments. Specific Objectives: 1. To engage students, educators, and administrators to identify user needs and expectations for the virtual science laboratory. 2. To define the pedagogical, technical, and functional requirements that will guide the design of the Interactive Virtual Science Laboratory. 3. To develop a detailed conceptual design, including key features, interface layouts, and how users will navigate and use the virtual lab. 4. To compile comprehensive design documentation that communicates the lab's structure, features, and design rationale, enabling future development and implementation.		
Justification or purpose of the project (Contribution and expected results)		
Science education in Belize faces significant barriers due to the difficulty and cost of conducting physical laboratory sessions. Maintaining science labs requires ongoing investment in materials, equipment, and safety resources, which many institutions are unable to consistently provide. As a result, students often lack opportunities for hands-on experimentation. Online and distance learners are particularly affected, as they typically rely on video demonstrations and theoretical assignments in place of practical lab experiences. The design of an Interactive Virtual Science Laboratory (IVSL) offers a practical and sustainable solution to these challenges. Through digital simulations, students will be able to perform experiments from any location, repeat procedures as needed, and receive immediate feedback. This approach supports more inclusive and flexible science education. Instructors will also benefit from features such as automated assessments and progress tracking, helping to reduce their grading workload and improve instructional support. This project aims to address the identified challenges by producing a design that is informed by stakeholder needs and aligned with national goals for equitable, technology-enabled education. It will prioritize accessibility, sustainability, and long-term value to ensure the proposed solution can expand access to practical science learning while reducing institutional costs. The resulting design will also lay the groundwork for future development and implementation.		

Description of the product or service that the project will generate – Final deliverables of the project
This project will result in a comprehensive design package for an Interactive Virtual Science Laboratory (IVSL) tailored to the needs of secondary and post-secondary science students in Belize. The deliverables will provide a foundation for future development and implementation. Each component of the design will reflect stakeholder input, educational requirements, and principles of accessibility and sustainability. Final Deliverables: 1. A comprehensive virtual lab design document detailing the lab's structure, key features, user experience, and how it supports science education goals. It will also include technical and teaching details, such as compatibility with learning platforms, accessibility features, and a clear explanation of design decisions. 2. A basic visual layout or prototype layout that illustrates how students and educators will interact with the virtual laboratory. It will include simple screen examples and navigation paths to demonstrate the structure, functionality, and key user actions.
Assumptions
1. Students, teachers, and administrators will be available and willing to share feedback during the design process. 2. The digital tools needed for research, design, and prototyping will be accessible and work properly throughout the project. 3. Enough information will be available on curriculum standards and learning goals to guide the educational design of the lab. 4. The main features of the virtual lab will be possible to build in the future using existing web or software technology. 5. The feedback collected from stakeholders will reflect the general needs of science education at the secondary and post-secondary levels in Belize.
Restrictions
1. The project is limited to producing a design only, and does not include development, testing, or implementation of the virtual laboratory. 2. The project must be completed within a six-month period, with a fixed end date of December 31, 2025. 3. Access to stakeholders may be limited by their availability during the academic calendar. 4. The final design must align with existing curriculum requirements and educational policies in Belize, which may limit flexibility in certain features.

5. The project must be completed within a fixed budget, which may limit the tools, services, or external support that can be used during the design process.
6. Identifying or accessing subject matter experts in educational technology or IT may be challenging due to limited availability or cost.

Preliminary risk identification

1. If school administrators do not support the project, it may be difficult to get permission to collect feedback from students and teachers, which could limit the quality of the design.
2. If key stakeholders like students or teachers are unavailable or do not respond during the consultation phase, the design may miss important input.
3. If curriculum standards or education requirements change during the project, the design may need updates, which could cause delays.
4. If experts in education technology or IT are not available or are too expensive to consult, the design may lack important technical details.
5. If the tools or software needed for design and prototyping are not readily available, or require skills beyond the team's expertise, the project could be delayed, and the final design may not meet quality expectations.

General Resources and Budget

The total project budget is USD \$5,821.20

Category	Amount (USD)
Total Cost of Deliverables	\$5,390.00
Contingency (5%)	\$269.50
Total Cost Baseline	\$5,686.50
Management Reserve (3%)	\$161.70
Total Project Budget	\$5,821.20

Milestone schedule

Milestone Name	End date
Project Start	July 1, 2025
Stakeholder Feedback Completed	July 16, 2025
Requirements Document Approved	August 1, 2025
Conceptual Design Approved	September 30, 2025
Prototype Layout Presented	November 21, 2025
Final Design Package Delivered	December 18, 2025
Project Closure and Final Approval	December 24, 2025

Relevant historical information

Catalyst Educational Services is a Belizean education company focused on making science learning more accessible, engaging, and inclusive. As the company continues to grow, it is expanding its services to include digital tools that support practical science learning beyond the traditional classroom. The design of an Interactive Virtual Science Laboratory (IVSL) is a new step in this direction. It aims to better support both classroom and online learners, especially those who have limited access to physical lab spaces.

This project is inspired by global practices where virtual simulations and digital labs are used to improve science education. These models have shown that virtual tools can help students stay engaged, learn independently, and better understand scientific concepts. By learning from these international efforts, Catalyst aims to create a virtual lab design that is locally relevant, sustainable, and able to meet the needs of students and teachers in Belize.

Identification of interest groups (involved)

Direct Interest Groups:

- Project Manager
- Project Team
- Science Educators
- Secondary and Post-secondary Students

Indirect Interest Groups:

- School Administrators
- Curriculum Development Unit- Ministry of Education, Science and Technology
- The Association of Tertiary Level Institutions in Belize (ATLIB)
- Education NGOs
- Future Developers or Implementation Teams

Project Manager:

Aisha Leiva

Signature:

**Name and position of the person
authorizing (facilitator):**

Signature:

Note. Own work.

4.2 Scope Management Plan

Introduction

Project Scope Management is the process of making sure that a project includes all the work required and only the work required to successfully complete the project (PMI, 2017, p. 129). It helps guide the project team in defining what work is included in the project and what is not. This way time, cost, and resources are used efficiently.

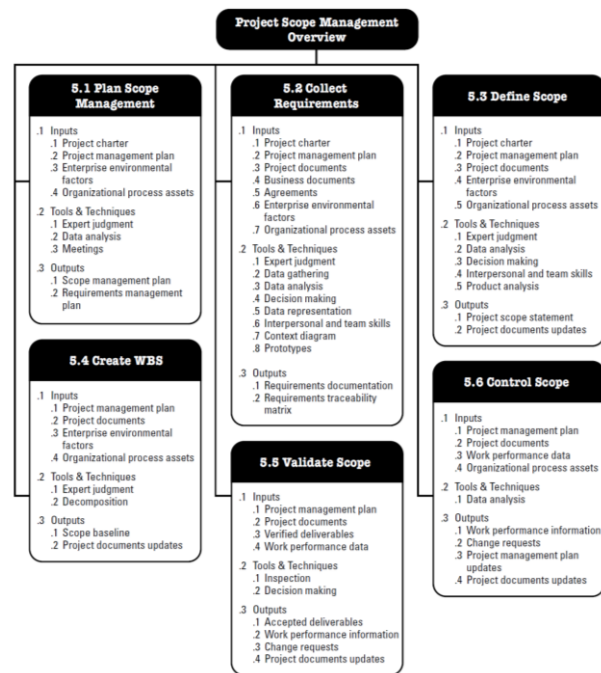
This Scope Management Plan outlines how the scope for the Design of an Interactive Virtual Science Laboratory (IVSL) will be defined, developed, validated, and controlled. The goal is to prevent scope creep and to make sure that deliverables match stakeholder needs. There must also be a clear plan for managing any changes to the scope. This Scope Management Plan is part of the project and supports the second specific objective defined.

According to the PMBOK® Guide – Sixth Edition, Project Scope Management includes the following six processes:

1. Plan Scope Management
2. Collect Requirements
3. Define Scope
4. Create WBS (Work Breakdown Structure)
5. Validate Scope
6. Control Scope

These processes are supported by a set of inputs, tools and techniques, and outputs. See the **Figure 13** below for a visual summary of the inputs, tools and techniques, and outputs related to Scope Management processes.

Figure 13. Overview of the Project Scope Management Processes.



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, 6th Edition, (Project Management Institute, 2017) Figure 5-1 p. 130.

4.2.1 Scope Management Approach

This section describes the specific approach that will be used to manage the scope of the Interactive Virtual Science Laboratory (IVSL) project. The goal is to define the work clearly, avoid unnecessary tasks, and handle changes in a structured way to meet stakeholder needs and project objectives.

The project will follow a predictive approach, meaning that the full scope will be defined during the planning phase. Stakeholders will be involved early to share their needs and help define project requirements.

The Scope Management Plan will include:

- How the scope will be written and approved
- The process for collecting and managing requirements
- The scope statement
- The Work Breakdown Structure (WBS) and WBS Dictionary
- How deliverables will be reviewed and accepted
- How changes to scope will be evaluated and approved

A Project Steering Committee (PCS) will be formed to provide oversight and support during the planning and execution of the project. This committee would consist of senior stakeholders, such as representatives from the Ministry of Education, school administrators, and members of the project sponsor's office. The Project Manager will lead the scope management process and supported by the project team. The scope baseline, which includes the scope statement, WBS, and WBS dictionary, will be approved at the end of the planning phase.

The Steering Committee will also serve as the Change Control Board. They are responsible for reviewing, evaluating, and approving any proposed changes to the project scope. Each request would be assessed based on its impact on time, cost, quality, and resources. Once approved, scope changes would be documented and reflected in the updated scope baseline.

4.2.1.1 Roles and Responsibilities

Clear assignment of responsibilities supports better scope planning, validation, and change management. Each person or group involved in the project plays a specific role in helping to define, document, and maintain control over the project scope. **Table 7** below outlines the main participants and their responsibilities related to scope management in the IVSL project.

Table 7. Roles and responsibilities in Scope Management

Role	Responsibilities
Project Manager	• Leads the development of the Scope Management Plan. • Coordinates requirement collection • Prepares the scope statement, WBS, and WBS Dictionary. • Oversees change request preparation and documentation.
Project Team	• Assists in collecting and analyzing requirements • Helps break down deliverables into the WBS • Supports the development of the scope baseline.
Project Sponsor	• Reviews and approves the scope statement • Provides strategic direction and approves major scope decisions.
Steering Committee	• Provides oversight during scope planning • Reviews and advises on scope decisions that impact time, cost, or quality. • Serves as the Change Control Board (CCB) • Responsible for reviewing, evaluating, and approving all scope change requests • Ensures approved changes are documented and shared with key stakeholders
Stakeholders	• Participate in requirement collection • Provide input to scope definition and validation • Help ensure deliverables meet actual needs
Subject Matter Experts (SMEs)	• Provide input during requirement collection • Help clarify technical or instructional content needed for scope definition

Note. Own work.

4.2.2 Requirements Collection

Collecting requirements involves determining, documenting, and organizing the needs and expectations of stakeholders. For this project, the process focuses on gathering input to inform the design of an Interactive Virtual Science Laboratory (IVSL) for students and educators in Belize. These requirements form the basis for defining the project and product scope and are later used to develop the Work Breakdown Structure (WBS) and other planning documents (PMI, 2017).

To ensure the IVSL design meets real educational needs, the project uses data-gathering techniques such as interviews, focus group discussions, and online surveys with students, teachers, and administrators. It also includes document analysis of curriculum standards, educational policies, and similar virtual lab projects. These tools help identify the technical, instructional, and accessibility requirements needed for the lab. Stakeholders come from both secondary and post-secondary education levels, and their feedback helps define how the lab should function. The use of expert judgment from science educators and IT professionals supports the development of technical and pedagogical requirements.

All collected requirements are organized and prioritized based on their importance to the project objectives. These requirements are documented in a Requirements Traceability Matrix found in **Table 8**. This matrix links each requirement to the related deliverables and acceptance criteria and supports traceability and ensures alignment with stakeholder expectations and project scope throughout the planning process.

Table 8. Requirements Traceability Matrix

ID	Requirement description	Business objective	Project objective	Priority	Source	Acceptance criteria	Project deliverable
R-01	Students should be able to access the IVSL platform from home using a standard internet connection.	Increase access to practical science education	Ensure remote access through online platform design	High	Stakeholder survey	Users can log in and use the lab without additional software	Access Plan section of the Virtual Lab Design Document
R-02	Simulations should align with the national science curriculum for secondary and junior college levels.	Support alignment with curriculum standards	Define curriculum-aligned educational content requirements	High	Curriculum documents	Content maps directly to syllabus topics	Curriculum Mapping section of the Virtual Lab Design Document
R-03	The platform should propose safety instructions for each lab activity.	Promote responsible and safe lab practices	Define safety-related functional requirements	Medium	Subject Matter Experts	Each activity displays clear safety instructions before starting	Safety Protocol section of the Virtual Lab Design Document
R-04	Teachers should be able to plan to track student progress on lab activities.	Enhance instructional support and monitoring	Define teacher tracking and monitoring features	High	Teacher focus group	Teacher dashboard displays student completion data	Instructional Tools section of the Virtual Lab Design Document
R-05	The IVSL should propose built-in assessment tools such as quizzes.	Support learning evaluation	Include automated assessment in design documentation	Medium	Teacher interviews	Quizzes auto-grade and provide results to users	Formative Assessment section of the Virtual Lab Design Document
R-06	The system should be mobile-responsive to allow	Maximize platform accessibility	Outline technical requirements	High	Accessibility recommendations	Platform loads and functions	Visual Prototype Layout

ID	Requirement description	Business objective	Project objective	Priority	Source	Acceptance criteria	Project deliverable
	access via tablets or smartphones.		for accessibility on various devices		from virtual lab literature	on tablets and phones	
R-07	The lab interface should use simple navigation to reduce learning curves.	Improve user experience	Design user-friendly layout and interface navigation	Medium	Best practices in educational UI/UX design	Users complete tasks without needing external instructions	Visual Prototype Layout
R-09	The IVSL should plan to track data on how students interact with lab activities.	Provide insights for improvement	Propose data collection features for usage monitoring	Low	Stakeholder input	System logs time spent and actions taken during lab sessions	Monitoring and Reporting section of the Virtual Lab Design Document
R-10	Students should be able to download lab summaries after completion.	Allow review and reflection outside platform	Include download feature in design to support offline review	Medium	Student focus group	Download button generates PDF summary of completed lab	Post-Activity Features section of the Virtual Lab Design Document

Note. Own work.

4.2.3 Scope Definition

Defining scope means creating a clear and detailed description of the project and product. It builds on the requirements that are collected. It also helps set boundaries for what is and is not included in the project. For this project, the goal is to define what the Interactive Virtual Science Laboratory (IVSL) looks like in terms of its features and functions. The main output of this process is the Project Scope Statement. This document includes a detailed description of the deliverables, assumptions, and constraints of the project. It also helps guide the development of the WBS. **Table 9** below presents the project scope statement for Catalyst Educational Services' design of an Interactive Virtual Science Laboratory (IVSL) project.

Table 9. Catalyst Educational Services Project Scope Statement

Project Scope Statement	
Project Details	
Project Name	Design of an Interactive Virtual Science Laboratory (IVSL) for Catalyst Educational Services
Budget	USD \$5,821.20
Duration	6 months
Scope Description	This project involves designing an Interactive Virtual Science Laboratory (IVSL) for secondary and post-secondary science learners in Belize. The scope includes stakeholder consultation, requirement collection, and the creation of a complete virtual lab design and visual prototype layout. The design addresses user needs, curriculum alignment, access features, instructional tools, and safety considerations.
Project Deliverables	1. Visual Prototype Layout - A user interface mock-up that shows the structure, navigation, and key features of the IVSL platform. 2. Virtual Lab Design Document - A written plan that outlines the lab's intended simulations, access requirements, instructional

Project Scope Statement	
	components, safety guidance, and alignment with curriculum standards
Scope Exclusions	This project does not include: 1. Development, coding, or implementation of the IVSL platform. 2. Testing and deployment 3. User training activities
Acceptance Criteria	The project's deliverables will be accepted when: 1. The virtual lab design aligns with curriculum standards and meets stakeholder-identified needs. 2. All planned design components are clearly described and traceable to collected requirements. 3. The proposed interface and functional features are documented and visually represented in the prototype layout. 4. Design outputs are complete, consistent, and ready for future development.
Assumptions	These are believed to be true for planning the design of the Interactive Virtual Science Laboratory: 1. Students, teachers, and administrators will be available and willing to share feedback during the design process. 2. The digital tools needed for research, design, and prototyping will be accessible and work properly throughout the project. 3. Enough information will be available on curriculum standards and learning goals to guide the educational design of the lab. 4. The main features of the virtual lab will be possible to build in the future using existing web or software technology. 5. The feedback collected from stakeholders will reflect the general needs of science education at the secondary and post-secondary levels in Belize.
Constraints	These define the limitations that shape design decisions: 1. The project is limited to producing a design only, and does not include development, testing, or implementation of the virtual laboratory. 2. The project must be completed within a six-month period, with a fixed end date of December 31, 2025.

Project Scope Statement	
	3. Access to stakeholders may be limited by their availability during the academic calendar. 4. The final design must align with existing curriculum requirements and educational policies in Belize, which may limit flexibility in certain features. 5. The project must be completed within a fixed budget, which may limit the tools, services, or external support that can be used during the design process. 6. Identifying or accessing subject matter experts in educational technology or IT may be challenging due to limited availability or cost.
Scope Statement Approval	
Date:	
Scope Statement Decision ☐ Approved ☐ Approved with modifications ☐ Rejected	

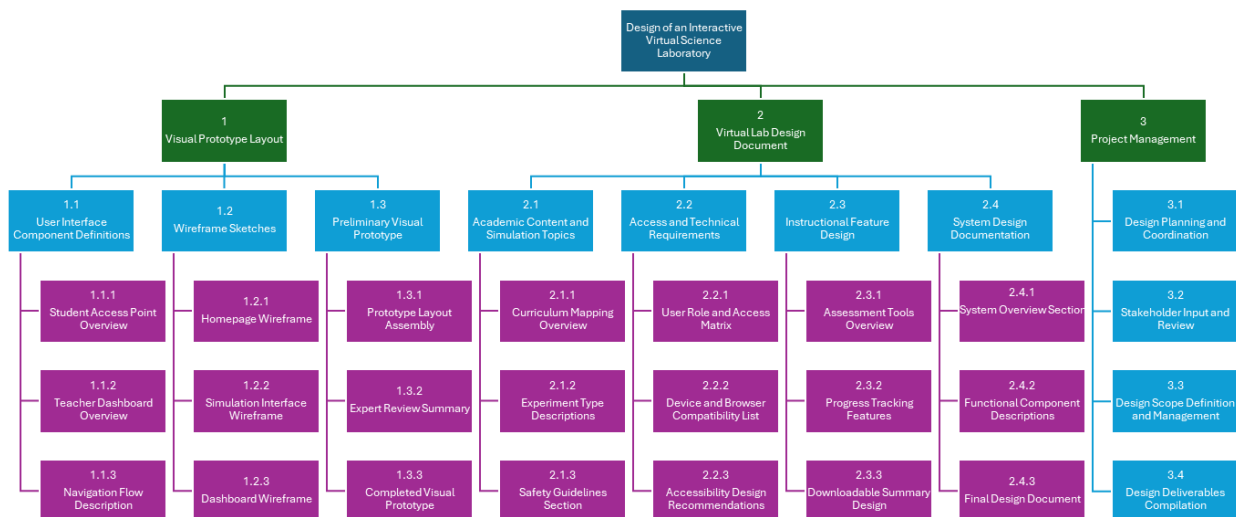
Note. Own work.

4.2.4 Work Breakdown Structure (WBS)

Create WBS is the fourth process of Project Scope Management. It involves breaking down the project deliverables and work into smaller, manageable parts called work packages (PMI, 2017). This breakdown helps the project team better understand the full scope of work, which in turn helps with estimating time and cost, assigning responsibilities, and monitoring progress. For the design of the IVSL, the WBS provides a clear picture of the design activities needed to produce the two main deliverables which are the visual prototype layout and the virtual lab design document. According to the PMBOK® Guide – Sixth Edition, the key benefit of this process is that it provides a structured framework of what must be delivered. It ensures that all project work is captured in the WBS and organized around deliverables, not tasks (PMI, 2017). The main output of

this process is the scope baseline, which includes the approved version of the scope statement, WBS, and WBS dictionary. The WBS is not a schedule or list of tasks. It is a “deliverable-oriented hierarchical decomposition” of the total project scope (PMI, 2006, p. 3). Each level becomes more detailed and ends in work packages. The WBS used in this captures all the scope defined in the scope statement and nothing extra. The WBS for Catalyst Educational Service’s design of an IVSL project is found below in **Figure 14**.

Figure 14. Work Breakdown Structure



Note. Own work.

4.2.4.1 WBS Dictionary

The WBS Dictionary gives more details about each work package in the Work Breakdown Structure. The WBS Dictionary supports the design of the Interactive Virtual Science Laboratory (IVSL) by clearly explaining each part of the design work, ensuring that the team and stakeholders understand what needs to be done. It helps keep the project organized and ensures that all planned work is understood and aligned with the project

scope. The WBS Dictionary for the design of the Interactive Virtual Science Laboratory (IVSL) is present in **Table 10** below.

Table 10. WBS Dictionary

Level	WBS Code	WBS Name	Description of Work
1	1	Visual Prototype Layout	Design the visual structure of the IVSL interface using sketches and a basic prototype.
2	1.1	User Interface Component Definitions	Identify the key user-facing elements such as access points and dashboards.
3	1.1.1	Student Access Point Overview	Describe how students will enter and navigate the lab.
3	1.1.2	Teacher Dashboard Overview	Outline the features available to teachers for monitoring student progress.
3	1.1.3	Navigation Flow Description	Map out how users move between pages and features in the IVSL.
2	1.2	Wireframe Sketches	Develop simple visual representations of major interface screens.
3	1.2.1	Homepage Wireframe	Sketch the layout and structure of the IVSL homepage.
3	1.2.2	Simulation Interface Wireframe	Sketch the interface students will use for lab simulations.
3	1.2.3	Dashboard Wireframe	Sketch the teacher and student dashboard layout.
2	1.3	Preliminary Visual Prototype	Assemble and refine a basic version of the IVSL interface to show layout and key features.
3	1.3.1	Prototype Layout Assembly	Create an initial digital version of the prototype using design tools.
3	1.3.2	Expert Review Summary	Gather feedback from subject matter experts on the initial prototype.
3	1.3.3	Completed Visual Prototype	Incorporate feedback and finalize the visual prototype design.
1	2	Virtual Lab Design Document	Create a detailed written design document for the IVSL, including simulations, instructional features, and system structure.
2	2.1	Academic Content and Simulation Topics	Define the educational content and science simulations based on curriculum standards.

Level	WBS Code	WBS Name	Description of Work
3	2.1.1	Curriculum Mapping Overview	Outline how the lab aligns with the national science curriculum.
3	2.1.2	Experiment Type Descriptions	List and describe the types of virtual experiments to be included.
3	2.1.3	Safety Guidelines Section	Include safety instructions and considerations for virtual lab activities.
2	2.2	Access and Technical Requirements	Plan for device compatibility, access levels, and user roles.
3	2.2.1	User Role and Access Matrix	Define access levels for different user types such as students and teachers.
3	2.2.2	Device and Browser Compatibility List	List compatible devices and browsers for using the IVSL.
3	2.2.3	Accessibility Design Recommendations	Suggest accessibility features for students with special needs.
2	2.3	Instructional Feature Design	Design tools and features that support teaching and learning.
3	2.3.1	Assessment Tools Overview	Describe how students will be assessed in the virtual lab.
3	2.3.2	Progress Tracking Features	Define how student progress will be recorded and viewed.
3	2.3.3	Downloadable Summary Design	Design the format and function for downloadable lab summaries.
2	2.4	System Design Documentation	Document the technical structure and layout of the IVSL system.
3	2.4.1	System Overview Section	Provide a general description of the system components and architecture.
3	2.4.2	Functional Component Descriptions	Detail the main functions and parts of the virtual lab system.
3	2.4.3	Final Design Document	Prepare the completed, formatted document presenting the IVSL design.
1	3	Project Management	Plan and manage the design process, including coordination, scope control, and final documentation.
2	3.1	Design Planning and Coordination	Coordinate tasks, timelines, and resources for the design process.
2	3.2	Stakeholder Input and Review	Engage stakeholders to collect feedback and input on the design.
2	3.3	Design Scope Definition and Management	Define and control the boundaries and content of the design.

Level	WBS Code	WBS Name	Description of Work
2	3.4	Design Deliverables Compilation	Assemble all final design materials and documents for review.

Note. Own work.

4.2.5 Validate Scope

Validate Scope is the process of formalizing acceptance of the completed project deliverables. It helps ensure that each part of the project has been completed as planned and meets the expectations of stakeholders. For the design of the IVSL this process involves reviewing each component of the lab design such as the prototype layout and written design document against the requirements defined earlier in the scope management plan. These requirements are recorded in the Requirements Traceability Matrix. Because this project focuses on planning and design, deliverables are validated through walkthroughs, expert reviews, and approval from identified stakeholders.

The roles and responsibilities described earlier guide who participates in this process. The Project Manager leads the validation activities. The core team members help prepare materials for review. Stakeholders and members of the Project Steering Committee give feedback and formally approve each deliverable based on the defined acceptance criteria. The main output of this process is accepted deliverables.

4.2.6 Control Scope

Control Scope is the process of monitoring the status of the project and managing changes to the scope baseline. This process helps ensure that only the approved work is included. It also ensures any changes are properly reviewed and documented. In this project, Control Scope applies to the planning and design of the lab. Scope control focuses on making sure that the design deliverables match what was approved in the scope

statement and Requirements Traceability Matrix. If any changes to the deliverables are needed, they must go through a formal review process.

All scope changes are handled through a Change Request Form. This form includes details such as the reason for the change and its expected effect on time, cost, or quality.

The Change request form can be found in **Appendix 5**. Once submitted, the change request is reviewed by the Project Manager and the Project Steering Committee. Each decision whether approved, rejected, or deferred is recorded in a Change Log. If changes are approved, the scope baseline is updated accordingly. The Change Log helps track the history of scope changes and maintain version control. The Change Log can be found in **Appendix 6**.

4.3 Schedule Management Plan

Introduction

Project schedule management includes the processes required to manage the timely completion of the project. It also includes planning, estimating the duration of tasks, organizing them in the correct order, and tracking their progress (PMI, 2017, p. 173). For this project, it ensures that all deliverables for the Interactive Virtual Science Laboratory (IVSL) are completed within the planned timeline. Maintaining a clear and realistic schedule helps the project team stay focused and aligned with the project's goals.

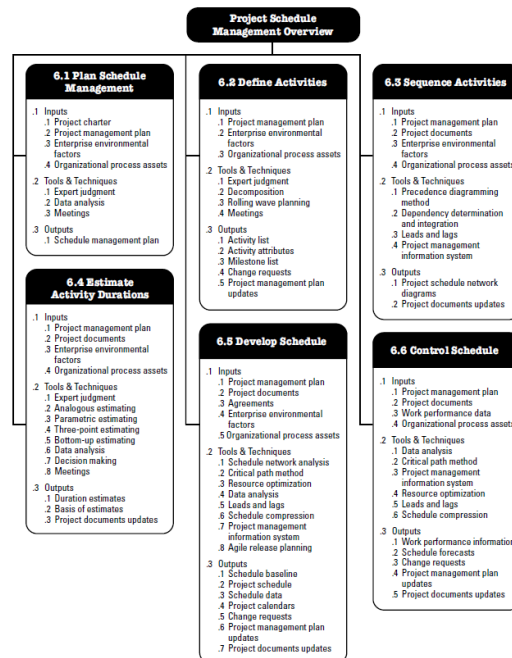
This Schedule Management Plan is part of the project and supports the third specific objective defined. It outlines how the schedule will be planned, developed, monitored, and controlled. There must also be a clear plan for managing any changes to the schedule. According to the PMBOK® Guide – Sixth Edition, Project Schedule Management includes the following six processes:

1. Plan Schedule Management
2. Define Activities
3. Sequence Activities
4. Estimate Activity Durations
5. Develop Schedule
6. Control Schedule

These processes help the Project Manager and team to break down the work, identify relationships between tasks, estimate durations, and track progress. Microsoft Project is used to prepare the activity list, milestone list, Gantt chart, and critical path

diagram. See the **Figure 15** below for a visual summary of the inputs, tools and techniques, and outputs related to Schedule Management processes.

Figure 15. Overview of the Project Schedule Management Processes



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* – 6th Edition, (Project Management Institute, 2017) Figure 6-1, p. 174

4.3.1 Schedule Management Approach

The schedule management approach describes how the project schedule will be planned, developed, and maintained throughout the life of the project. It includes the tools that will be used and how estimates will be made. The project schedule provides a clear roadmap for coordinating tasks, tracking progress, and ensuring that all planned activities align with the project's objectives and timeframe.

For the Interactive Virtual Science Laboratory (IVSL) design project, the Project Manager is responsible for developing and updating the schedule using Microsoft Project 2019. The Project Manager will be supported by the Project Team, guided by the Project Sponsor, and advised by the Steering Committee on important scheduling decisions. Control of the schedule will include comparing actual progress with planned dates, identifying delays, and taking corrective action when necessary. Any changes to the schedule will follow a formal review and approval process.

The Schedule Management Plan is structured to include:

- Schedule management approach
- Activity list with estimates and dependencies
- Milestone list
- Project schedule with Gantt chart and critical path
- General procedures for schedule control

4.3.2 Define, Sequence and Estimate Activities

Define Activities is the process of identifying and documenting the specific actions needed to produce the project deliverables. These actions are developed from the Work Breakdown Structure (WBS). Each work package is broken down into manageable tasks (PMI, 2017, p. 183). In this project, the activity list is created by examining each WBS work package and describing the steps required to complete it. Some of the key outputs of this process include the activity list and the milestone list. A milestone list identifies significant points in the project. It includes the milestone name, start and end dates. Each milestone is linked to major deliverables. The milestone list used for this project is shown

in **Table 11** below. The activity list was later consolidated with sequence, dependency and duration information in a single table. It is presented later in this section.

Table 11. Milestone List

Milestone Name	Start Date	End Date
Project Start	July 1, 2025	July 1, 2025
Stakeholder Feedback Completed	July 9, 2025	July 16, 2025
Requirements Document Approved	July 17, 2025	August 1, 2025
Conceptual Design Approved	August 2, 2025	September 30, 2025
Prototype Layout Presented	October 1, 2025	November 21, 2025
Final Design Package Delivered	November 22, 2025	December 18, 2025
Project Closure and Final Approval	December 19, 2025	December 24, 2025

Note. Own work.

Sequence Activities is the process of identifying and documenting relationships among project activities. It helps the project team determine the order in which tasks should be performed to complete the work efficiently and avoid delays (PMI, 2017, p. 188). This process involves analyzing each activity to see whether it must happen before, after, or at the same time as others. For this project, the activities are grouped into phases. Each task is reviewed to identify any dependencies. Some activities can begin in parallel, while others must follow a specific order. The full list of activities and their predecessors is shown in the activity list later in this section.

Estimate Activity Durations is the process of estimating how much time each activity will take to complete, which helps the project team plan a schedule that is realistic and achievable (PMI, 2017, p. 200). For this project, several tools and techniques are used. Expert judgment is used by relying on the knowledge and experience of team members and subject matter experts. Analogous estimating is utilized by comparing the tasks to similar activities done in similar projects. The complexity of each task and the number of people available are also considered when estimating durations. These techniques create a realistic schedule. **Table 12** below shows the full activity list with the start and end dates, estimated durations, and predecessors.

Table 12. Activity List

ID	Task Name	Duration	Start	Finish	Predecessors
1	IVSL Design Project	127 days	Tue 7/1/25	Wed 12/24/25	
2	1 Visual Prototype Layout	53 days	Wed 9/10/25	Fri 11/21/25	
3	1.1 User Interface Component Definitions	15 days	Wed 9/10/25	Tue 9/30/25	
4	1.1.1 Student Access Point Overview	8 days	Wed 9/10/25	Fri 9/19/25	
5	1.1.1.1 Draft navigation steps for student login	3 days	Wed 9/10/25	Fri 9/12/25	
6	1.1.1.2 Identify user interface elements for students	2 days	Mon 9/15/25	Tue 9/16/25	5
7	1.1.1.3 Document user flow in written form	3 days	Wed 9/17/25	Fri 9/19/25	6
8	1.1.2 Teacher Dashboard Overview	7 days	Mon 9/22/25	Tue 9/30/25	
9	1.1.2.1 List dashboard features for teachers	2 days	Mon 9/22/25	Tue 9/23/25	7
10	1.1.2.2 Describe data displayed (e.g., grades, activity)	3 days	Wed 9/24/25	Fri 9/26/25	9
11	1.1.2.3 Summarize reporting functions available	2 days	Mon 9/29/25	Tue 9/30/25	10

ID	Task Name	Duration	Start	Finish	Predecessors
12	1.1.3 Navigation Flow Description	8 days	Wed 9/17/25	Fri 9/26/25	
13	1.1.3.1 Draw initial flowchart of user navigation	3 days	Wed 9/17/25	Fri 9/19/25	6
14	1.1.3.2 Validate navigation logic with mock walkthrough	3 days	Mon 9/22/25	Wed 9/24/25	13
15	1.1.3.3 Revise flowchart based on feedback	2 days	Thu 9/25/25	Fri 9/26/25	14
16	1.2 Wireframe Sketches	25 days	Wed 10/1/25	Tue 11/4/25	
17	1.2.1 Homepage Wireframe	8 days	Wed 10/1/25	Fri 10/10/25	
18	1.2.1.1 Identify homepage content sections	2 days	Wed 10/1/25	Thu 10/2/25	
19	1.2.1.2 Draw basic layout sketch	4 days	Fri 10/3/25	Wed 10/8/25	18
20	1.2.1.3 Label all interactive components	2 days	Thu 10/9/25	Fri 10/10/25	19
21	1.2.2 Simulation Interface Wireframe	10 days	Mon 10/13/25	Fri 10/24/25	
22	1.2.2.1 Define experiment area and controls	3 days	Mon 10/13/25	Wed 10/15/25	20
23	1.2.2.2 Sketch visual interface for simulation tasks	5 days	Thu 10/16/25	Wed 10/22/25	22
24	1.2.2.3 Annotate user actions and response areas	2 days	Thu 10/23/25	Fri 10/24/25	23
25	1.2.3 Dashboard Wireframe	7 days	Mon 10/27/25	Tue 11/4/25	
26	1.2.3.1 Identify dashboard data elements	3 days	Mon 10/27/25	Wed 10/29/25	24
27	1.2.3.2 Create layout sketch	2 days	Thu 10/30/25	Fri 10/31/25	26
28	1.2.3.3 Review for consistency with UI goals	2 days	Mon 11/3/25	Tue 11/4/25	27
29	1.3 Preliminary Visual Prototype	13 days	Wed 11/5/25	Fri 11/21/25	
30	1.3.1 Prototype Layout Assembly	8 days	Wed 11/5/25	Fri 11/14/25	
31	1.3.1.1 Set up design file in software tool	3 days	Wed 11/5/25	Fri 11/7/25	
32	1.3.1.2 Import wireframes and link pages	2 days	Mon 11/10/25	Tue 11/11/25	31

ID	Task Name	Duration	Start	Finish	Predecessors
33	1.3.1.3 Apply basic styling and labels	3 days	Wed 11/12/25	Fri 11/14/25	32
34	1.3.2 Expert Review Summary	5 days	Mon 11/17/25	Fri 11/21/25	
35	1.3.2.1 Share prototype with subject matter experts	5 days	Mon 11/17/25	Fri 11/21/25	33
36	2 Virtual Lab Design Document	111 days	Thu 7/17/25	Thu 12/18/25	
37	2.1 Academic Content and Simulation Topics	37 days	Thu 7/17/25	Fri 9/5/25	
38	2.1.1 Curriculum Mapping Overview	12 days	Thu 7/17/25	Fri 8/1/25	
39	2.1.1.1 Review national science curriculum	7 days	Thu 7/17/25	Fri 7/25/25	86
40	2.1.1.2 Map lab modules to learning outcomes	5 days	Mon 7/28/25	Fri 8/1/25	39
41	2.1.2 Experiment Type Descriptions	20 days	Mon 8/4/25	Fri 8/29/25	
42	2.1.2.1 List key experiment categories	3 days	Mon 8/4/25	Wed 8/6/25	40
43	2.1.2.2 Write experiment overviews	12 days	Thu 8/7/25	Fri 8/22/25	42
44	2.1.2.3 Ensure simulations match curriculum objectives	3 days	Mon 8/25/25	Wed 8/27/25	43
45	2.1.2.4 Consult subject experts for validation	2 days	Thu 8/28/25	Fri 8/29/25	44
46	2.1.3 Safety Guidelines Section	5 days	Mon 9/1/25	Fri 9/5/25	
47	2.1.3.1 Identify potential safety concerns	2 days	Mon 9/1/25	Tue 9/2/25	
48	2.1.3.2 Write virtual safety guidelines	3 days	Wed 9/3/25	Fri 9/5/25	47
49	2.2 Access and Technical Requirements	7 days	Mon 9/1/25	Tue 9/9/25	
50	2.2.1 User Role and Access Matrix	4 days	Mon 9/1/25	Thu 9/4/25	
51	2.2.1.1 Define student and teacher roles	2 days	Mon 9/1/25	Tue 9/2/25	
52	2.2.1.2 Assign permission levels	2 days	Wed 9/3/25	Thu 9/4/25	51
53	2.2.2 Device and Browser Compatibility List	7 days	Mon 9/1/25	Tue 9/9/25	

ID	Task Name	Duration	Start	Finish	Predecessors
54	2.2.2.1 Survey available devices and browsers	2 days	Mon 9/1/25	Tue 9/2/25	
55	2.2.2.2 Verify functionality on major platforms	3 days	Wed 9/3/25	Fri 9/5/25	54
56	2.2.2.3 Document compatibility list	2 days	Mon 9/8/25	Tue 9/9/25	55
57	2.2.3 Accessibility Design Recommendations	7 days	Mon 9/1/25	Tue 9/9/25	
58	2.2.3.1 Identify accessibility needs	2 days	Mon 9/1/25	Tue 9/2/25	
59	2.2.3.2 Propose solutions for screen readers and color contrast	3 days	Wed 9/3/25	Fri 9/5/25	58
60	2.2.3.3 Document recommendations	2 days	Mon 9/8/25	Tue 9/9/25	59
61	2.3 Instructional Feature Design	5 days	Mon 11/24/25	Fri 11/28/25	
62	2.3.1 Assessment Tools Overview	5 days	Mon 11/24/25	Fri 11/28/25	
63	2.3.1.1 List assessment types	2 days	Mon 11/24/25	Tue 11/25/25	
64	2.3.1.2 Describe scoring and feedback methods	3 days	Wed 11/26/25	Fri 11/28/25	63
65	2.3.2 Progress Tracking Features	5 days	Mon 11/24/25	Fri 11/28/25	
66	2.3.2.1 Identify progress metrics	2 days	Mon 11/24/25	Tue 11/25/25	
67	2.3.2.2 Draft progress dashboard elements	3 days	Wed 11/26/25	Fri 11/28/25	66
68	2.3.3 Downloadable Summary Design	5 days	Mon 11/24/25	Fri 11/28/25	
69	2.3.3.1 Define what data will be included	2 days	Mon 11/24/25	Tue 11/25/25	
70	2.3.3.2 Design printable/downloadable template	3 days	Wed 11/26/25	Fri 11/28/25	69
71	2.4 System Design Documentation	14 days	Mon 12/1/25	Thu 12/18/25	
72	2.4.1 System Overview Section	3 days	Mon 12/1/25	Wed 12/3/25	
73	2.4.1.1 Draft description of system components	3 days	Mon 12/1/25	Wed 12/3/25	
74	2.4.2 Functional Component Descriptions	6 days	Thu 12/4/25	Thu 12/11/25	

ID	Task Name	Duration	Start	Finish	Predecessors
75	2.4.2.1 Write descriptions for each function	3 days	Thu 12/4/25	Mon 12/8/25	73
76	2.4.2.2 Link each function to system requirement	3 days	Tue 12/9/25	Thu 12/11/25	75
77	2.4.3 Final Design Document	5 days	Fri 12/12/25	Thu 12/18/25	
78	2.4.3.1 Combine all sections into single document	2 days	Fri 12/12/25	Mon 12/15/25	76
79	2.4.3.2 Review for consistency and completeness	3 days	Tue 12/16/25	Thu 12/18/25	78
80	3 Project Management	127 days	Tue 7/1/25	Wed 12/24/25	
81	3.1 Design Planning and Coordination	3 days	Tue 7/1/25	Thu 7/3/25	
82	3.1.1 Develop project timeline	3 days	Tue 7/1/25	Thu 7/3/25	
83	3.1.2 Assign roles and responsibilities	2 days	Tue 7/1/25	Wed 7/2/25	
84	3.2 Stakeholder Input and Review	7 days	Tue 7/8/25	Wed 7/16/25	
85	3.2.1 Create stakeholder engagement plan	3 days	Tue 7/8/25	Thu 7/10/25	
86	3.2.2 Collect and consolidate feedback	4 days	Fri 7/11/25	Wed 7/16/25	85
87	3.3 Design Scope Definition and Management	5 days	Tue 7/1/25	Mon 7/7/25	
88	3.3.1 Write scope statement	3 days	Tue 7/1/25	Thu 7/3/25	
89	3.3.2 Review with sponsor	2 days	Fri 7/4/25	Mon 7/7/25	88
90	3.4 Design Deliverables Compilation	4 days	Fri 12/19/25	Wed 12/24/25	
91	3.4.1 Gather all completed files	2 days	Fri 12/19/25	Mon 12/22/25	79,35
92	3.4.2 Organize and archive for handoff	2 days	Tue 12/23/25	Wed 12/24/25	91

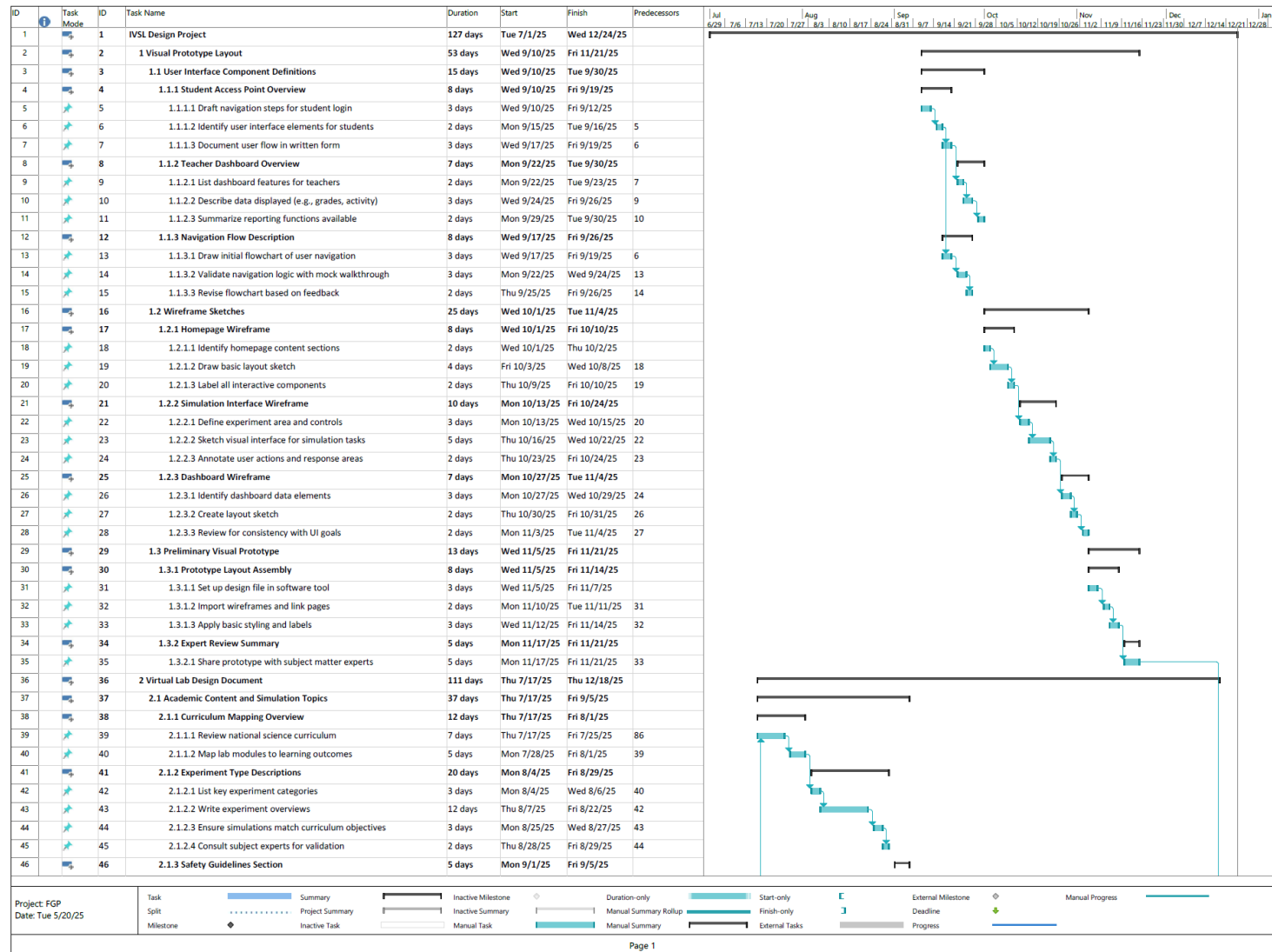
Note. Own work.

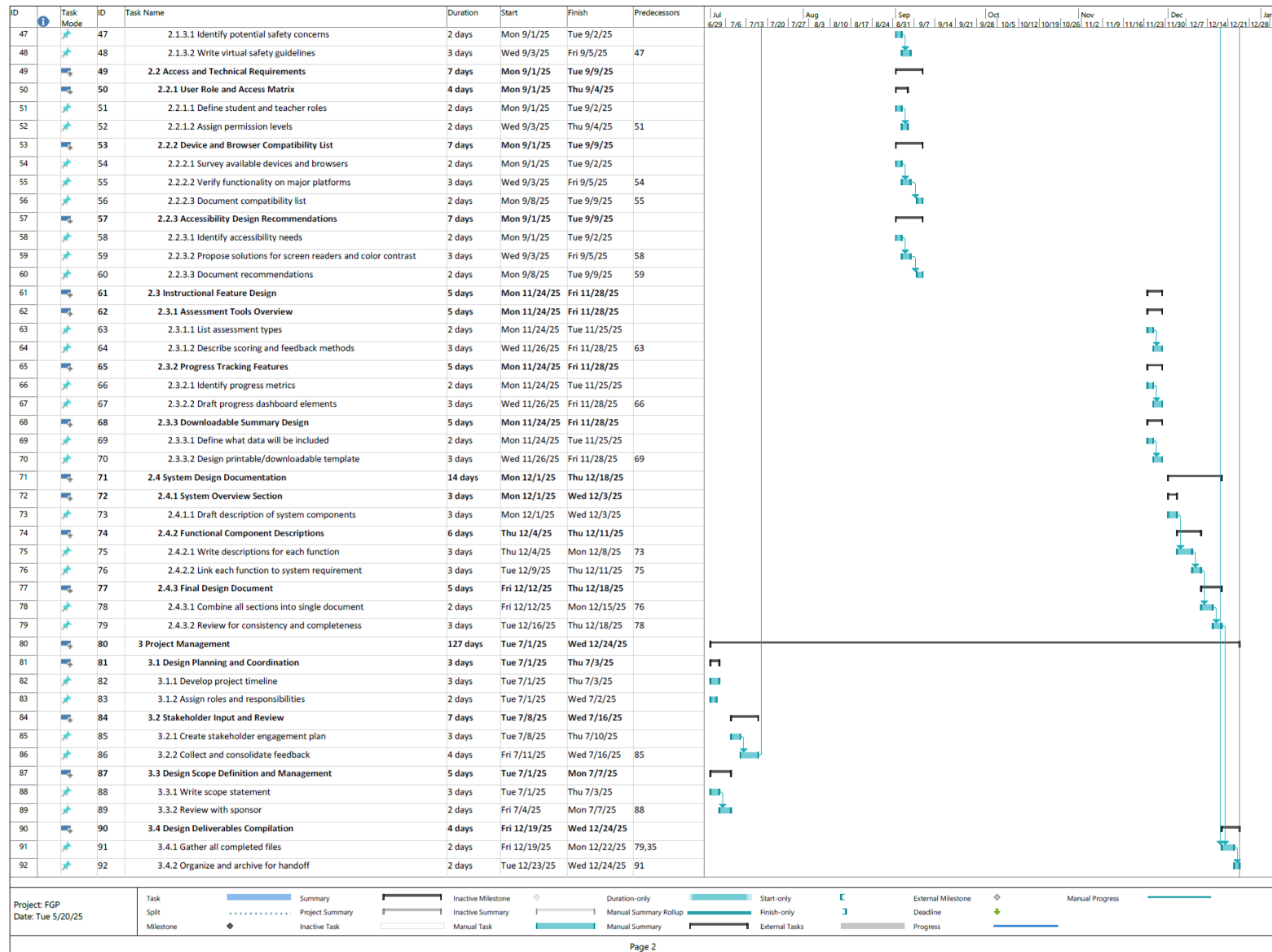
4.3.3 Develop Schedule

Develop Schedule is the process of analyzing activity sequences, durations, resource availability, and constraints to create the project schedule (PMI, 2017, p. 205). This process uses the information from the activity list, durations, and dependencies to organize the work over time. In this project, Microsoft Project 2019 is used to build the schedule by entering the activities, their durations and dependencies. There are tasks that occur the same time are scheduled in parallel. Other tasks must follow a specific sequence. The result is a complete project schedule that shows when each activity starts and finishes. The schedule is presented using a Gantt chart as shown in **Figure 16**. The Gantt chart displays the tasks along a timeline of six months. One of the key outputs of the process is the schedule baseline. The schedule baseline is the approved version of the schedule. It is used to track actual progress against planned dates.

The critical path is the sequence of activities that determines the shortest possible time to complete the project (PMI, 2017, p. 210). Any delay in one of these activities will directly affect the project's finish date. In this project, the critical path begins with 2.4.1.1 Draft description of system components and continues through system documentation and final review activities. It includes 2.4.2.1 Write descriptions for each function, 2.4.2.2 Link each function to system requirement, and both final design tasks: 2.4.3.1 Combine all sections into single document and 2.4.3.2 Review for consistency and completeness. It then moves into the last phase with 3.4.1 Gather all completed files and ends with 3.4.2 Organize and archive for handoff. These tasks are shown in red on the Gantt chart. The critical path is displayed in **Figure 17** and helps the project team identify the sequence of work that controls the overall duration.

Figure 16. Project Schedule Gannt Chart





Note. Own work.

Figure 17. Project Critical Path - Gantt Chart View



Note. Own work

4.3.4 Control Schedule

Control Schedule is the process of monitoring the status of the project to update the project schedule and manage changes to the schedule baseline (PMI, 2017, p. 222). This process helps ensure that activities are completed as planned and that the timeline is maintained. For this project, schedule control focuses on reviewing progress, checking if tasks are being completed on time, and identifying any changes that may affect the finish date. If changes are needed, they must be formally reviewed and approved before being added to the schedule.

The Project Manager is responsible for tracking progress and updating the schedule. Team members are involved in reporting task status. The Project Sponsor and the Project Steering Committee participate in the review of major changes. The final approval is made by the Change Control Board (CCB). All schedule adjustments must be submitted using the Change Request Form, which is found in **Appendix 5**. All changes are recorded in the Change Log in **Appendix 6**. These tools help maintain transparency and keep a record of all schedule changes throughout the project.

One of the key outputs of this process is schedule forecasts. These are generated using tools such as the Schedule Performance Index (SPI). SPI is a measure of how efficiently the project team is completing work. SPI is calculated by dividing the Earned Value (EV) by the Planned Value (PV). An SPI below 1 means the project is behind schedule, while an SPI above 1 means it is ahead. Using this metric, the project team can identify problems early and take corrective action.

4.4 Cost Management Plan

Introduction

Project cost management is the process of planning and controlling how much money is spent on a project. It includes planning, estimating, budgeting, financing, funding, managing, and controlling costs to complete the project within the approved budget (PMI, 2017). These activities help ensure that project funds are used in the best way. Good cost management also supports better decision-making throughout the project. This plan is important because it helps the Interactive Virtual Science Laboratory (IVSL) design project stay within budget. It supports the team in using resources wisely and avoiding unnecessary expenses. It also helps track costs and make sure the money is spent as planned.

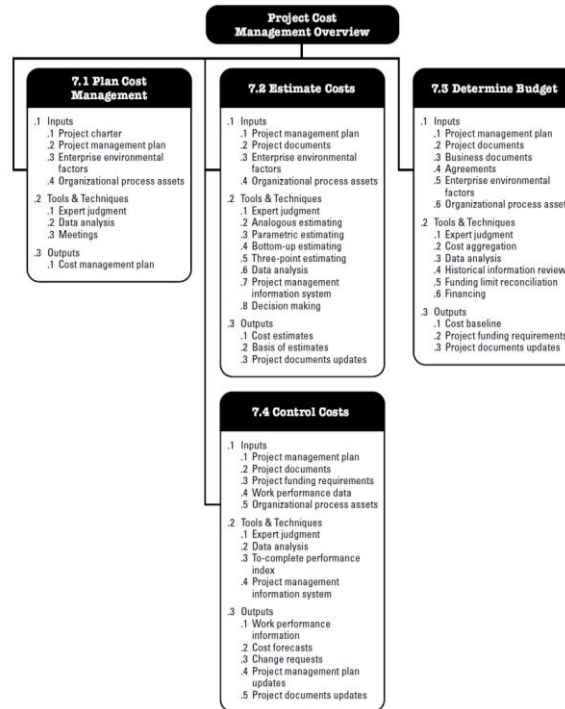
This Cost Management Plan supports Specific Objective 4 of the project which is to create a Cost Management Plan to describe how the costs for the design of the Interactive Virtual Science Laboratory will be planned, structured, and controlled to complete the project within the available resources. According to the PMBOK® Guide, Sixth Edition, there are four processes in project cost management:

1. Plan Cost Management
2. Estimate Costs
3. Determine Budget
4. Control Costs

These processes help the project team create a cost plan, check if costs are on track, and take action if needed. They also support financial reporting and help keep stakeholders informed. Each process plays a role in keeping the project within budget and aligned with

its financial goals. **Figure 18** below shows a summary of the main inputs, tools and techniques, and outputs used in these four cost processes.

Figure 18. Overview of Project Cost Management Processes



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* – 6th Edition, (Project Management Institute, 2017) Figure 7-1, p. 232

4.4.1 Cost Management Approach

The cost management approach explains how the team will plan, manage, and control costs during the project. It helps make sure the project stays within budget and avoids cost overruns. The main output of this process is the Cost Management Plan. This plan also explains how Earned Value Management (EVM) will be used to check how well the project is doing compared to the planned cost and schedule.

Cost management for the Interactive Virtual Science Laboratory (IVSL) design project involves estimating, budgeting, and monitoring all project expenses from start to

finish. The Project Manager is responsible for preparing and updating the cost management plan. The Instructional Designer, Technical Lead, and IT Support provide input on technical needs and costs. Cost decisions are made by the Project Manager in consultation with the project team and must be approved by the Project Sponsor. If a cost change is needed, a Change Request Form must be completed and submitted. The request is reviewed by the Project Steering Committee, which also serves as the Change Control Board for this project. Approved changes are recorded in the Change Log, and updates are made to the budget and cost baseline. The primary tools that will be used to manage costs include Microsoft Project and Microsoft Excel which provide several features to calculate and visualize project budgets.

The Cost Management Plan includes:

- Project Cost Estimate
- Project budget
- Cost baseline
- Contingency and Management reserves
- Process for tracking and reporting cost performance

4.4.2 Estimate Cost

The process of estimating costs involves identifying how much each activity is expected to cost. Recall that the work packages from the Work Breakdown Structure (WBS) were broken down into activities in the schedule management plan. This format helps the team understand how much money is needed to carry out the project work. For the Interactive Virtual Science Laboratory (IVSL) design project, cost estimation takes place during the planning phase using available data and expert input from the project team.

The Project Manager works closely with the Instructional Designer, Technical Lead, and IT Support to estimate the resources needed for each task.

Different cost estimation methods are used depending on the type of activity.

Analogous estimating is used for tasks from similar projects. Bottom-up estimating is used for more detailed tasks where specific cost items are known. In terms of data analysis, reserve analysis is used to include extra amounts for unexpected expenses. Note, a cost estimate is different from a budget. The cost estimate shows how much each activity is expected to cost. The budget adds these costs together including reserves. It sets the total amount of money the project is allowed to spend. The total estimated cost is presented below in **Table 13**. This estimation is done before applying any contingency or management reserve.

Table 13. Project Cost Estimate

WBS ID	WBS Component	Activity ID	Activity	Cost Estimate (USD)
1	Visual Prototype Layout			\$1,930
1.1	User Interface Component Definitions			\$790
1.1.1	Student Access Point Overview			
		1.1.1.1	Draft navigation steps for student login	\$105
		1.1.1.2	Identify user interface elements for students	\$80
		1.1.1.3	Document user flow in written form	\$105
	Teacher Dashboard Overview	1.1.2.1	List dashboard features for teachers	\$70
		1.1.2.2	Describe data displayed (e.g., grades, activity)	\$70
		1.1.2.3	Summarize reporting functions available	\$80

	Navigation Flow Description	1.1.3.1	Draw initial flowchart of user navigation	\$120
		1.1.3.2	Validate navigation logic with mock walkthrough	\$80
		1.1.3.3	Revise flowchart based on feedback	\$80
1.2	Wireframe Sketches			\$840
	Homepage Wireframe	1.2.1.1	Identify homepage content sections	\$70
		1.2.1.2	Draw basic layout sketch	\$120
		1.2.1.3	Label all interactive components	\$70
	Simulation Interface Wireframe	1.2.2.1	Define experiment area and controls	\$120
		1.2.2.2	Sketch visual interface for simulation tasks	\$120
		1.2.2.3	Annotate user actions and response areas	\$70
	Dashboard Wireframe	1.2.3.1	Identify dashboard data elements	\$70
		1.2.3.2	Create layout sketch	\$120
		1.2.3.3	Review for consistency with UI goals	\$80
1.3	Preliminary Visual Prototype			\$300
	Prototype Layout Assembly	1.3.1.1	Set up design file in software tool	\$80
		1.3.1.2	Import wireframes and link pages	\$70
		1.3.1.3	Apply basic styling and labels	\$70
	Expert Review Summary	1.3.2.1	Share prototype with subject matter experts	\$80
2	Virtual Lab Design Document			\$2,430
2.1	Academic Content and Simulation Topics			\$815
2.1.1	Curriculum Mapping Overview			
		2.1.1.1	Review national science curriculum	\$140
		2.1.1.2	Map lab modules to learning outcomes	\$105

2.1.2	Experiment Type Descriptions			
		2.1.2.1	List key experiment categories	\$70
		2.1.2.2	Write experiment overviews	\$140
		2.1.2.3	Ensure simulations match curriculum objectives	\$105
		2.1.2.4	Consult subject experts for validation	\$80
2.1.3	Safety Guidelines Section			
		2.1.3.1	Identify potential safety concerns	\$70
		2.1.3.2	Write virtual safety guidelines	\$105
2.2	Access and Technical Requirements			\$630
2.2.1	User Role and Access Matrix			
		2.2.1.1	Define student and teacher roles	\$70
		2.2.1.2	Assign permission levels	\$80
2.2.2	Device and Browser Compatibility List			
		2.2.2.1	Survey available devices and browsers	\$50
		2.2.2.2	Verify functionality on major platforms	\$120
		2.2.2.3	Document compatibility list	\$50
2.2.3	Accessibility Design Recommendations			
		2.2.3.1	Identify accessibility needs	\$70
		2.2.3.2	Propose solutions for screen readers and color contrast	\$120
		2.2.3.3	Document recommendations	\$70
2.3	Instructional Feature Design			\$555
2.3.1	Assessment Tools Overview			
		2.3.1.1	List assessment types	\$70
		2.3.1.2	Describe scoring and feedback methods	\$105
2.3.2	Progress Tracking Features			
		2.3.2.1	Identify progress metrics	\$70
		2.3.2.2	Draft progress dashboard elements	\$120
2.3.3	Downloadable Summary Design			
		2.3.3.1	Define what data will be included	\$70
		2.3.3.2	Design printable/downloadable template	\$120

2.4	System Design Documentation			\$430
2.4.1	System Overview Section	2.4.1.1	Draft description of system components	\$120
2.4.2	Functional Component Descriptions	2.4.2.1	Write descriptions for each function	\$120
		2.4.2.2	Link each function to system requirement	\$40
2.4.3	Final Design Document	2.4.3.1	Combine all sections into single document	\$70
		2.4.3.2	Review for consistency and completeness	\$80
3	Project Management			\$1,030
3.1	Design Planning and Coordination	3.1.1	Develop project timeline	\$120
		3.1.2	Assign roles and responsibilities	\$80
3.2	Stakeholder Input and Review	3.2.1	Create stakeholder engagement plan	\$80
		3.2.2	Collect and consolidate feedback	\$420
3.3	Design Scope Definition and Management	3.3.1	Write scope statement	\$120
		3.3.2	Review with sponsor	\$80
3.4	Design Deliverables Compilation	3.4.1	Gather all completed files	\$80
		3.4.2	Organize and archive for handoff	\$50
Estimated Project Cost				\$5,390

Note. Own work

4.4.3 Determine Budget

The process of determining the budget involves adding up all the estimated costs for the project activities and including reserves for unexpected changes, helping the project team know how much money is needed and when it will be spent. The result is a cost baseline that can be tracked throughout the project. For the Interactive Virtual Science

Laboratory (IVSL) design project, the total cost estimate is \$5,390 USD. This amount includes all planned project activities, such as design work, testing, documentation, and stakeholder engagement. A contingency reserve of 5% is added to cover possible risks or small changes. In addition, a management reserve of 3% is included for larger, unplanned changes that must be approved by the sponsor. **Table 14** below shows the calculation of the total project budget.

Table 14. Project Budget

Item	Percentage	Amount (USD)
Cost Estimate	-	\$5,390.00
Contingency Reserve	5%	\$269.50
Management Reserve	3%	\$161.70
Total Project Budget	-	\$5,821.20

Note. Own work

The cost baseline includes the original cost estimate and the 5% contingency reserve as seen in **Table 15** below. It will be used to measure performance during project execution. Any changes to the baseline must go through the change control process.

Table 15. Project Cost Baseline

Item	Amount (USD)
Project Cost Estimate	\$5,390.00
Contingency Reserve (5%)	\$269.50
Cost Baseline	\$5,659.50

Note. Own work

A cost distribution table was developed and is found below in **Table 16**. It shows the monthly breakdown of planned expenditures by activity and work package over the 6-month design phase of the IVSL project.

Table 16. Cost Distribution

WBS ID	WBS Component	Activity ID	Activity	Cost Estimate (USD)	Jul	Aug	Sept	Oct	Nov	Dec
1	Visual Prototype Layout			\$1,930						
1.1	User Interface Component Definitions			\$790						
1.1.1	Student Access Point Overview									
		1.1.1.1	Draft navigation steps for student login	\$105			\$105			
		1.1.1.2	Identify user interface elements for students	\$80			\$80			
		1.1.1.3	Document user flow in written form	\$105			\$105			
	Teacher Dashboard Overview	1.1.2.1	List dashboard features for teachers	\$70			\$70			
		1.1.2.2	Describe data displayed (e.g., grades, activity)	\$70			\$70			
		1.1.2.3	Summarize reporting functions available	\$80			\$80			
	Navigation Flow Description	1.1.3.1	Draw initial flowchart of user navigation	\$120			\$120			
		1.1.3.2	Validate navigation logic with mock walkthrough	\$80			\$80			
		1.1.3.3	Revise flowchart based on feedback	\$80			\$80			
1.2	Wireframe Sketches			\$840						

WBS ID	WBS Component	Activity ID	Activity	Cost Estimate (USD)	Jul	Aug	Sept	Oct	Nov	Dec
	Homepage Wireframe	1.2.1.1	Identify homepage content sections	\$70				\$70		
		1.2.1.2	Draw basic layout sketch	\$120				\$120		
		1.2.1.3	Label all interactive components	\$70				\$70		
	Simulation Interface Wireframe	1.2.2.1	Define experiment area and controls	\$120				\$120		
		1.2.2.2	Sketch visual interface for simulation tasks	\$120				\$120		
		1.2.2.3	Annotate user actions and response areas	\$70				\$70		
	Dashboard Wireframe	1.2.3.1	Identify dashboard data elements	\$70				\$70		
		1.2.3.2	Create layout sketch	\$120				\$120		
		1.2.3.3	Review for consistency with UI goals	\$80					\$80	
1.3	Preliminary Visual Prototype			\$300						
	Prototype Layout Assembly	1.3.1.1	Set up design file in software tool	\$80					\$80	
		1.3.1.2	Import wireframes and link pages	\$70					\$70	
		1.3.1.3	Apply basic styling and labels	\$70					\$70	
	Expert Review Summary	1.3.2.1	Share prototype with subject matter experts	\$80					\$80	
2	Virtual Lab Design Document			\$2,430						
2.1	Academic Content and Simulation Topics			\$815						
2.1.1										
		2.1.1.1	Review national science curriculum	\$140	\$140					

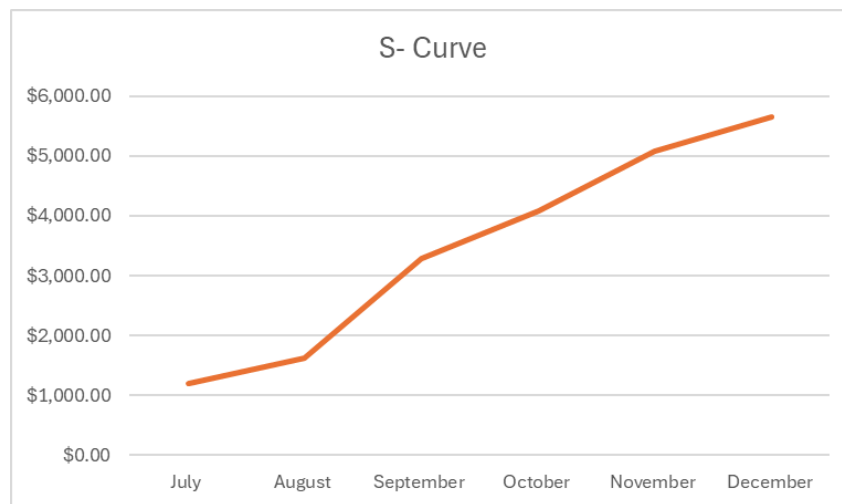
WBS ID	WBS Component	Activity ID	Activity	Cost Estimate (USD)	Jul	Aug	Sept	Oct	Nov	Dec
	Curriculum Mapping Overview	2.1.1.2	Map lab modules to learning outcomes	\$105	\$105					
2.1.2	Experiment Type Descriptions									
		2.1.2.1	List key experiment categories	\$70		\$70				
		2.1.2.2	Write experiment overviews	\$140		\$140				
		2.1.2.3	Ensure simulations match curriculum objectives	\$105		\$105				
		2.1.2.4	Consult subject experts for validation	\$80		\$80				
2.1.3	Safety Guidelines Section									
		2.1.3.1	Identify potential safety concerns	\$70			\$70			
		2.1.3.2	Write virtual safety guidelines	\$105			\$105			
2.2	Access and Technical Requirements			\$630						
2.2.1	User Role and Access Matrix									
		2.2.1.1	Define student and teacher roles	\$70			\$70			
		2.2.1.2	Assign permission levels	\$80			\$80			
2.2.2	Device and Browser Compatibility List									
		2.2.2.1	Survey available devices and browsers	\$50			\$50			
		2.2.2.2	Verify functionality on major platforms	\$120			\$120			
		2.2.2.3	Document compatibility list	\$50			\$50			
2.2.3	Accessibility Design Recommendations									
		2.2.3.1	Identify accessibility needs	\$70			\$70			
		2.2.3.2	Propose solutions for screen readers and color contrast	\$120			\$120			
		2.2.3.3	Document recommendations	\$70			\$70			
2.3	Instructional Feature Design			\$555						

WBS ID	WBS Component	Activity ID	Activity	Cost Estimate (USD)	Jul	Aug	Sept	Oct	Nov	Dec
	Stakeholder Input and Review	3.2.1	Create stakeholder engagement plan	\$80	\$80					
		3.2.2	Collect and consolidate feedback	\$420	\$420					
3.3	Design Scope Definition and Management									
		3.3.1	Write scope statement	\$120	\$120					
		3.3.2	Review with sponsor	\$80	\$80					
3.4	Design Deliverables Compilation									
		3.4.1	Gather all completed files	\$80						\$80
		3.4.2	Organize and archive for handoff	\$50						\$50
Estimated Project Cost				\$5,390.00	\$1,145.00	\$395.00	\$1,595.00	\$760.00	\$935.00	\$560.00
Contingency (5%)				\$269.50	\$57.25	\$19.75	\$79.75	\$38.00	\$46.75	\$28.00
Project Cost Baseline				\$5,659.50	\$1,202.25	\$414.75	\$1,674.75	\$798.00	\$981.75	\$588.00
Management Reserve (3%)				\$161.70						
Total Project Budget				\$5,821.20						

Note. Own work

The cost baseline can be depicted using an S curve to show how planned costs build up over time. An S curve was prepared to show the Planned Value (PV) over the 6 months and is seen below in **Figure 19**. It illustrates the planned cumulative spending from July to December 2025. This curve is based on the project's cost baseline of \$5,659.50, which includes both the cost estimate and the 5% contingency reserve. It helps the project team visualize how spending is expected to increase over time as work progresses.

Figure 19. S- Curve



Note. Own work

4.4.4 Control Cost

Control Costs is the process of monitoring project spending and ensuring that costs stay within the approved budget. It helps the project team understand if money is being used as planned. Control costs help to identify whether any changes are needed to keep the project financially on track. This process involves checking actual spending, comparing it to planned costs, and analyzing variances. For the IVSL design project, cost control happens throughout the 6 months and is done using Earned Value Analysis (EVA). EVA

helps measure how the project is performing in terms of both cost and schedule. It uses three main values:

- Planned Value (PV): The approved budget for the work that should have been completed by a specific date.
- Earned Value (EV): The approved budget for the work that was actually completed.
- Actual Cost (AC): The actual amount of money spent on the work that was completed.

These values are compared each month using the S curve, which was presented in the previous section. The S curve helps visualize how the actual cost (AC) and earned value (EV) align with the planned value (PV).

To measure performance, the project team will use the following formulas:

- Schedule Variance (SV) = $EV - PV$

A positive SV means the project is ahead of schedule; a negative SV means it is behind.

- Cost Variance (CV) = $EV - AC$

A positive CV means the project is under budget; a negative CV means it is over budget.

- Schedule Performance Index (SPI) = EV / PV

SPI shows schedule efficiency. $SPI > 1$ means work is being completed faster than planned.

- Cost Performance Index (CPI) = EV / AC

CPI shows cost efficiency. $CPI > 1$ means the project is spending less than expected.

Forecasting is also an important part of cost control. It helps the team estimate how much the project will cost at the end based on current performance. The following values are used:

- Budget at Completion (BAC): The total planned cost of the project.
- Estimate at Completion (EAC): The expected final cost of the project.

$$EAC = BAC / CPI.$$

- Estimate to Complete (ETC): The expected cost to finish the remaining work.

$$ETC = EAC - AC.$$

- To-Complete Performance Index (TCPI): The cost performance needed to finish the project within the budget.

$$TCPI = (BAC - EV) / (BAC - AC)$$

If cost variances are found during monitoring, the Project Manager will review them with the team. Minor issues will be tracked internally, but major changes will be submitted using the Change Request Form found in **Appendix 5**. These requests are reviewed by the Project Steering Committee which also acts as the Change Control Board (CCB). All changes are logged in the Change Log Form found in **Appendix 6**. The budget is updated if needed.

4.5 Quality Management Plan

Introduction

Project quality management is the process of incorporating quality standards into the planning, design, and evaluation of project deliverables. It includes identifying quality requirements, managing quality assurance during project execution, and controlling outputs to ensure they meet expectations (PMI, 2017). These activities help ensure that the final product satisfies stakeholder needs and performs as intended. Good quality management also supports continuous improvement and stakeholder satisfaction.

This Quality Management Plan is important because it helps ensure that the Interactive Virtual Science Laboratory (IVSL) design meets educational and technological standards. It supports the project team in building quality into each stage of the design process. It also helps verify that outputs meet agreed-upon criteria and that stakeholder expectations are fulfilled.

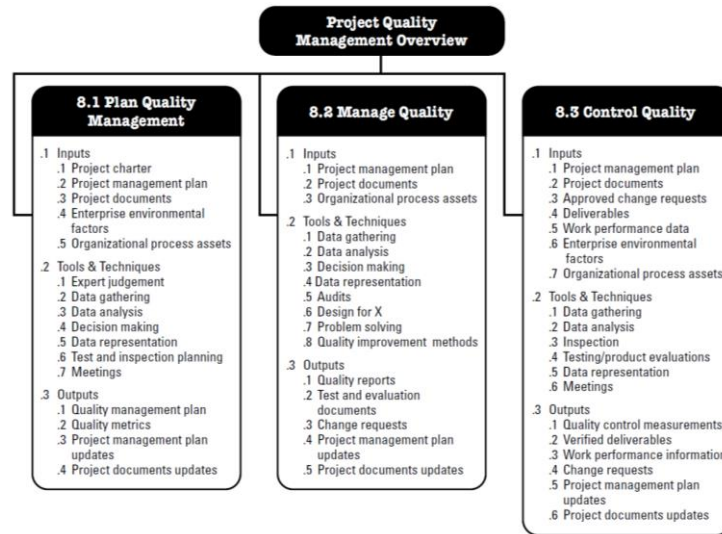
This plan supports Specific Objective 5 of the project, which is to create a Quality Management Plan to define quality standards and ensure the design meets educational and technological requirements. According to the PMBOK® Guide, Sixth Edition, there are three processes in project quality management:

1. Plan Quality Management
2. Manage Quality
3. Control Quality

These processes help the project team define quality expectations, apply quality assurance during the project, and check that the outputs meet those expectations. Each process plays a role in improving the final results and supporting continuous feedback

during the design of the IVSL. **Figure 20** below shows a summary of the main inputs, tools and techniques, and outputs used in these three quality processes.

Figure 20. Overview of Project Quality Management Processes



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* – 6th Edition, (Project Management Institute, 2017) Figure 8-1, p. 272

4.5.1 Quality Management Approach

The quality management approach explains how quality is planned, defined, and measured in this project. For the Interactive Virtual Science Laboratory (IVSL), quality means that the design must meet educational needs, be easy to use, and align with accepted standards. Quality is not just checked at the end—it is built into each phase of the project.

This approach combines stakeholder input with professional standards. Feedback from educators and students helps identify what quality means in the context of a virtual science laboratory. To prioritize these expectations, the project uses the MoSCoW method, a technique that classifies requirements into four categories: Must have, Should have,

Could have, and Won't have. The insights gathered will be compared with results from benchmarking similar virtual labs. The approach ensures the design reflects user needs while meeting accepted educational standards.

One of the main outputs of this process includes the Quality Management Plan, which explains how quality is managed and what standards apply. The plan also assigns roles and responsibilities for quality. The Project Manager works with the instructional designer, the technical team, and a small group of educators to ensure quality is built into the lab structure. Each team member is expected to follow quality checklists and report issues early. If deliverables do not meet quality standards, the team uses a change request to review and correct the problem. A second key output of this process is a set of quality metrics. These are the measurements used to check if the IVSL meets expectations. These metrics are shown in **Table 17** below.

Table 17. Quality Metrics

Quality Objective	Metric	Metric definition	Expected outcome/result	Measurement frequency	Responsible
Ensure user-friendly interface	Ease of navigation score	Average rating of ease of use by users	≥ 4 out of 5	During usability testing	Instructional Designer
Maintain high system reliability	System uptime percentage	Percentage of time the system is available without crashes	$\geq 99\%$ uptime during testing	Weekly during development	Technical Lead
Ensure content accuracy	Content error rate	Number of factual or formatting errors per module	0–1 error per module	After content upload	Content Editor
Achieve stakeholder satisfaction	Stakeholder satisfaction score	Average rating from post-demo survey by teachers/stakeholders	$\geq 85\%$ positive feedback	After stakeholder review session	Project Manager

Quality Objective	Metric	Metric definition	Expected outcome/result	Measurement frequency	Responsible
Comply with curriculum standards	Curriculum alignment score	Score based on checklist comparing lab content with national science curriculum	$\geq 90\%$ content match	During final quality review	Instructional Designer
Ensure cross-device compatibility	Device compatibility test score	Number of major devices and browsers where the IVSL functions correctly	Works on at least 3 devices and 2 browsers	During final testing phase	Technical Lead

Note. Own work

4.5.2 Manage Quality

Manage Quality is the process of applying the quality plan during the project to make sure that quality standards are followed. This process is also referred to as quality assurance. It helps to make sure that the IVSL design meets expectations and is created using good practices. For this project, the team uses a checklist to review work, identify errors early, and confirm that tasks follow the quality plan. It confirms that quality tasks are completed correctly. The checklist is shown below in **Table 18**.

Table 18. Quality Checklist

Task/Item to Review	Responsible Party	Checked (Yes/No)	Comments
Interface layout follows design guidelines	Instructional Designer		
All buttons and links function correctly	Technical Lead		
Content is factually accurate and free of typos	Content Editor		
Lab simulations load without errors	Technical Lead		

Task/Item to Review	Responsible Party	Checked (Yes/No)	Comments
System is accessible on desktop, tablet, and phone	Technical Lead		
Assessment tools (quizzes/forms) function properly	Instructional Designer		
User instructions are clear and visible	Instructional Designer		
Stakeholder review feedback is documented	Project Manager		
Checklist completed before milestone approval	Project Manager		
Change requests documented for any quality issues	Project Manager		
Internal quality audit completed and documented	Project Manager		

Note. Own work

The Manage Quality process also uses the Plan-Do-Check-Act (PDCA) cycle to guide quality improvement. The team plans quality tasks, does the work, checks the results, and acts to make changes when needed. In addition to checklists and PDCA, the team uses other quality tools during this process. These include root cause analysis and alternatives analysis. These tools help improve how the virtual lab is designed and reviewed. Internal quality audits are also conducted during this process. These are informal reviews to check if the team is following the quality plan, using checklists correctly, and applying agreed design standards. The audits help catch issues early and improve the way quality is managed throughout the IVSL project. The Internal Audit Form is found in **Appendix 7**.

If any changes are needed, the team uses the Change Request Form found in **Appendix 5**. Changes are documented using the Change Log Form found in **Appendix 6**. Lessons learned are also recorded to improve future work. The Lessons Learned Log Form is found in **Appendix 9**. Remember that managing quality involves everyone. The instructional designer, technical staff, and project manager all help make sure the lab meets the quality standards.

4.5.3 Control Quality

Control Quality is the process of checking deliverables to confirm they meet quality standards. This step focuses on the final product, not the process used to create it. It helps the project team verify that the design of the Interactive Virtual Science Laboratory (IVSL) is complete, accurate, and ready for acceptance. In this project, Control Quality is applied after each major component of the IVSL is finished. The team inspects the outputs and compares them against the quality metrics listed in **Table 17**. This inspection includes checking the layout, content accuracy, functionality, and compatibility with devices and browsers. Findings from each inspection are documented using the Inspection Report Log found in **Appendix 10**.

The team also collects quality control measurements, such as performance scores, error counts, or satisfaction ratings. If problems are found, the team uses the Change Request Form found in **Appendix 5** and updates the Change Log in **Appendix 6**. The Project Manager works with the instructional designer and technical team to carry out this process. This step ensures that the IVSL meets its quality goals before the design is

finalized. It gives stakeholders confidence that the lab is complete, accurate, and aligned with educational standards.

4.6 Resource Management Plan

Introduction

Project resource management is the process of planning, estimating, acquiring, developing, managing, and controlling the resources needed to complete a project successfully (PMI, 2017). Resources include both human resources such as team members and subject matter experts and physical resources like equipment, software and tools. Effective resource management helps ensure that the right people and tools are available at the right time. It promotes accountability and supports task completion. It also helps the team stay on schedule and within budget.

This Resource Management Plan supports Specific Objective 6 of the project, which is to create a Resource Management Plan to determine and allocate the resources needed for the design of the Interactive Virtual Science Laboratory (IVSL). According to the PMBOK® Guide, Sixth Edition, there are six processes in project resource management:

1. Plan Resource Management
2. Estimate Activity Resources
3. Acquire Resources
4. Develop Team
5. Manage Team
6. Control Resources

These six processes guide how resources are identified, assigned, and monitored. Each one supports the successful planning and coordination of the IVSL design project. **Figure 21** below shows a summary of the main inputs, tools and techniques, and outputs used in these six processes.

Figure 21. Overview of Project Resource Management Processes

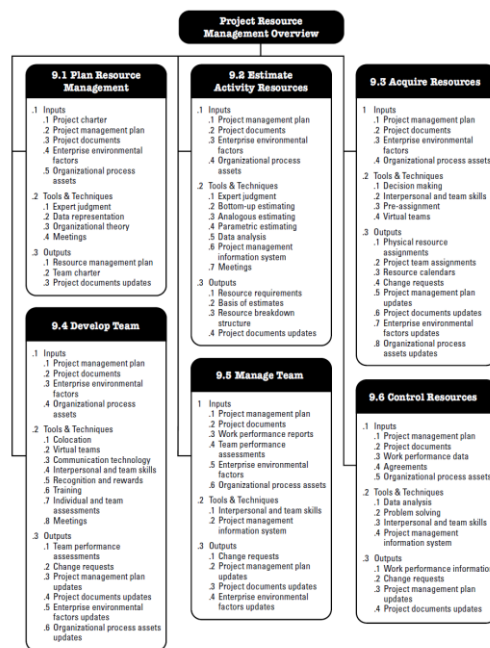


Figure 9-1. Project Resource Management Overview

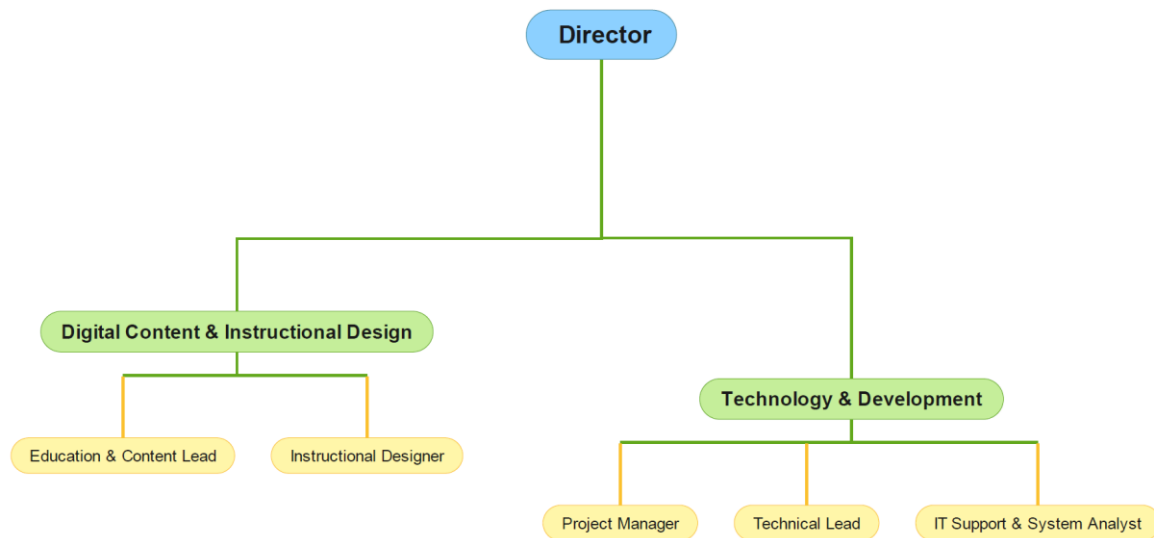
Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* – 6th Edition, (Project Management Institute, 2017) Figure 9-1, p. 308

4.6.1 Resource Management Approach

Plan Resource Management is the process of defining how to estimate, acquire, manage, and use resources, both human and physical, for the project (PMI, 2017). The goal is to make sure the right people and tools are available to complete the project tasks effectively. In this project, the process helps organize the work needed to design the Interactive Virtual Science Laboratory (IVSL).

For this project, the team uses Organizational Breakdown Structure (OBS) and the Work Breakdown Structure (WBS) to support the planning of the resource management approach. The OBS, shown in **Figure 22** below, shows how the team is grouped by function. It highlights the three main units: Digital Content & Instructional Design, Technology & Development, and Operations & Business Development.

Figure 22. Organizational Breakdown Structure



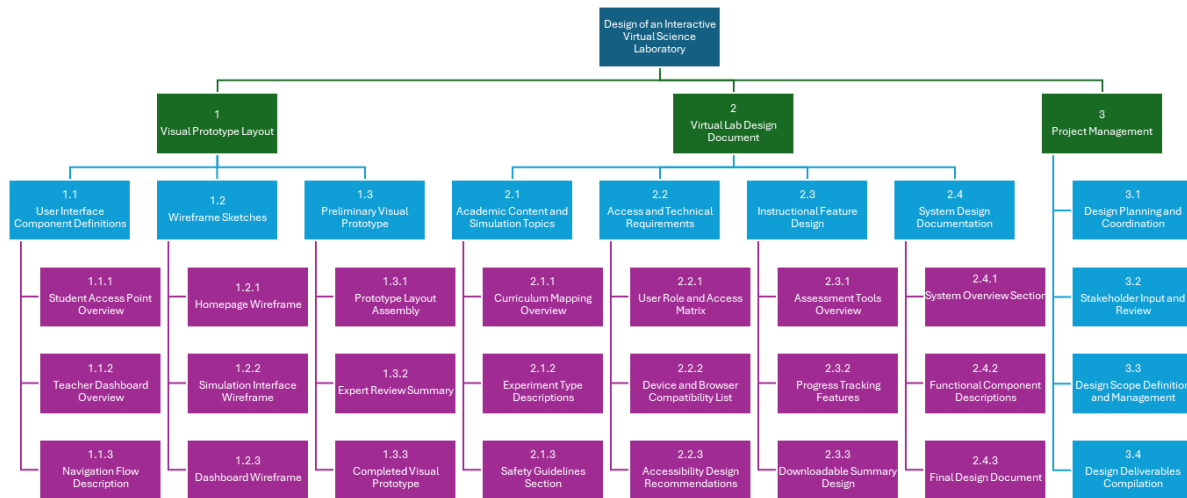
Note. Own work

The WBS breaks down the IVSL design into three major work packages: Visual Prototype Layout, Virtual Lab Design Document, and Project Management. Each work package is broken down into activities as seen in the Schedule and Cost Management Plans. The resources, both team and physical, needed to complete those activities per work package are determined. By linking each activity to its required resources, the WBS

supports better coordination among team members and ensures that no tasks are left without adequate support.

The WBS is shown in **Figure 23** below.

Figure 23. Work Breakdown Structure



Note. Own work

Another important tool is the RACI matrix, which is a type of Responsibility Assignment Matrix (RAM). It helps clarify who is Responsible, Accountable, Consulted, and Informed for each major task. This matrix ensures that everyone knows their role and helps avoid overlaps in responsibilities.

- Responsible (R): the person who does the work.
- Accountable (A): the person who approves the work and ensures completion.
- Consulted (C): individuals who give input.
- Informed (I): individuals who are kept updated.

The RACI matrix is found in **Table 19** below.

Table 19. RACI Matrix

WBS Code	Work Package Name	Project Manager	Project Steering Committee	Instructional Designer	Education & Content Lead	Technical Lead	IT Support & System Analyst
1.1	User Interface Component Definitions	A	I	R	C	C	I
1.2	Wireframe Sketches	A	I	R	C	C	I
1.3	Preliminary Visual Prototype	A	I	R	C	C	I
2.1	Academic Content and Simulation Topics	I	A	C	R	I	I
2.2	Access and Technical Requirements	C	A	I	I	R	R
2.3	Instructional Feature Design	A	I	R	C	C	I
2.4	System Design Documentation	C	A	C	C	R	R
3.1	Design Planning and Coordination	R	A	C	C	C	I
3.2	Stakeholder Input and Review	R	A	C	C	I	I
3.3	Design Scope Definition and Management	R	A	C	C	C	I
3.4	Design Deliverables Compilation	R	A	C	C	I	I
R = Responsible A = Accountable C = Consult I = Inform							

Note. Own work

One of the main outputs of this process is the Resource Management Plan. This plan includes:

- Roles and responsibilities for each team member
- The RACI matrix
- The Resource Breakdown Structure (RBS)
- A plan to acquire, manage, and release resources
- Strategies for managing the team
- Methods for tracking resource performance

Another key output of this process is the Team Charter. It outlines the team's shared values, working agreements, and communication guidelines. It helps build trust, sets clear expectations, and supports collaboration. The Project Manager oversees resource coordination, while the Instructional Designer and Technical Lead manage resources in their specific areas.

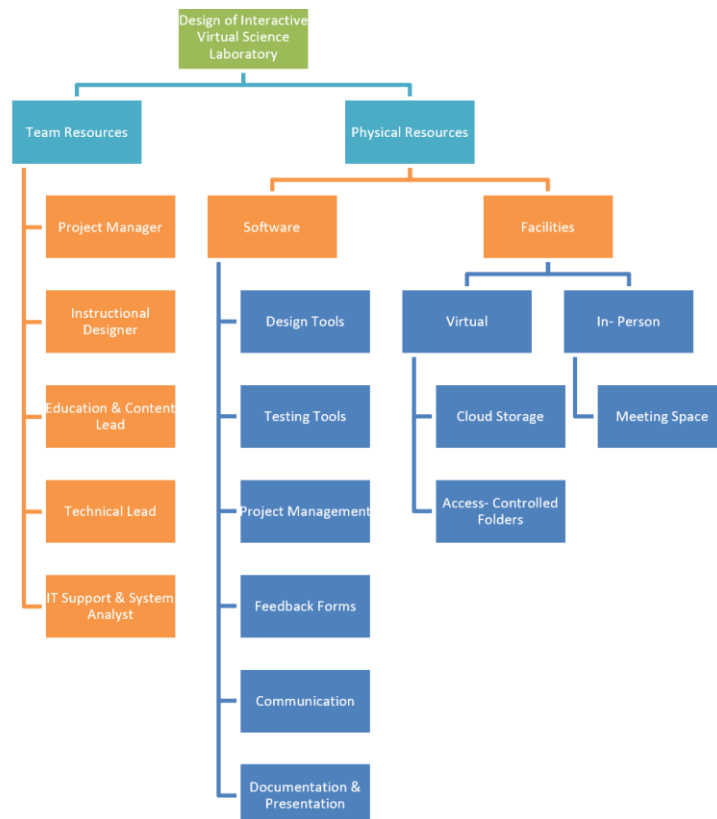
4.6.2 Estimate Activity Resources

Estimate Activity Resources is the process of estimating the type and number of resources needed to perform each activity in the project (PMI, 2017). These resources include team members, equipment, tools, and technology. Estimating helps the project team understand what is needed to complete the work and avoid delays or shortages. It also helps in preparing the budget and schedule. For the Interactive Virtual Science Laboratory (IVSL) design project, this process is used to estimate which roles are needed for each task and the types of physical resources that may be required. The team uses the Work Breakdown Structure (WBS) and the activity list to decide what resources are needed per

task. The estimation focuses on short-term activities related to digital content development, layout, technical input, and stakeholder engagement.

The main tools and techniques used in this process include expert judgment, data analysis, and project management software. Expert judgment is provided by the Project Manager, Instructional Designer, and Technical Lead, who use their experience to guide resource needs. Analogous estimating is based on similar work that team members have completed in other organizations. One of the key outputs of this process is the Resource Breakdown Structure (RBS). The RBS for this project is shown in **Figure 24** below.

Figure 24. Resource Breakdown Structure



Note. Own work

The RBS is a hierarchical chart that groups all project resources by category and function. As Catalyst Educational Services is a fully remote company, it is assumed that all team members will use their own equipment to carry out their assigned tasks. The RBS for the design of the IVSL is divided into two main categories: Team Resources and Physical Resources. The Team Resources includes all individuals involved in conducting the activities of the project. Physical Resources are further broken down into software and facilities. The facilities can be virtual or in-person.

Another important output of this process is the resource calendar. A resource calendar shows when each team member or physical resource is available to work on the project (PMI, 2017). For the IVSL design project, the calendar is based on a six-month timeline and considers the part-time availability of team members. It helps schedule activities realistically by showing when each person can contribute to specific tasks.

4.6.3 Acquire Resources

Acquire Resources is the process of obtaining the team members, equipment, materials, and facilities needed to carry out project activities (PMI, 2017). For the Interactive Virtual Science Laboratory (IVSL) design project, this means securing both the Team Resources and Physical Resources as shown in RBS. Catalyst Educational Services is a small and growing education company that operates fully online. Most roles are filled through short-term contracts or outsourcing. Most of the resources for this project are acquired externally. These include several contracted roles, such as the Instructional Designer, Technical Lead, and IT Support & System Analyst. These individuals are hired on a freelance or part-time basis to support the design of the virtual lab.

In addition to human resources, the project also acquires physical resources from external sources. These include software tools, as well as facilities that may be either virtual or in-person. The project arranges access to in-person facilities including meeting rooms for stakeholder engagement. The acquisition of these resources follows basic procurement steps which are described later on in the Procurement Management Plan. A few resources are internal to Catalyst Educational Services. These include the roles of the Project Manager, Education & Content Lead, and Director. They are part of the company's founding structure.

A key tool and technique used in this process includes virtual teams. Team members are expected to use their own equipment including laptops with internet access. This setup allows the project to operate without investing in physical assets. Team members interact through online platforms and share resources digitally. Some of the main outputs of this process include physical resource assignments, physical team assignments, and resource calendars. These outputs ensure that each team member knows their responsibilities, and that the project has access to all necessary resources to design the IVSL.

4.6.4 Develop Team

Develop Team is the process of improving the skills, trust, and teamwork of the project team to enhance overall performance (PMI, 2017). The purpose is to strengthen collaboration, to motivate team members and to ensure they can work well together. For the IVSL design project, this process supports the development of a small, remote team working under contract. Since Catalyst Educational Services operates fully online, team development focuses on building relationships virtually and creating a collaborative

environment. The Project Manager is responsible for encouraging teamwork and helping the team stay engaged.

The main tools and techniques used for this project include:

- Team-building activities such as virtual introductions, group brainstorming sessions, and shared working documents.
- Recognition and rewards including regular verbal appreciation and acknowledgment during group virtual meetings.

A main output of this process is the use of team performance assessments. These informal assessments help the Project Manager understand how well the team is collaborating and if additional support or motivation is needed. The goal is to help the team stay motivated and work well together.

4.6.5 Manage Team

Manage Team is the process of tracking team performance, giving feedback, resolving issues, and making changes to improve project results (PMI, 2017). This process helps ensure that the project team remains productive and aligned with the goals of the IVSL design project. It also supports early conflict resolution and helps the team stay motivated and organized. For this project, the Project Manager monitors progress through regular virtual check-ins and shared updates. Since the team is remote, clear expectations and ongoing collaboration are important. If issues arise, the Project Manager works with the team to resolve them quickly. The main tools and techniques used in this process are interpersonal and team skills. These skills include conflict management, emotional intelligence and leadership. Conflict management helps the Project Manager address

disagreements early before they affect progress. Emotional intelligence allows the Project Manager to understand and respond to team members' needs. Leadership helps keep the team motivated and focused on goals. A main output of this process is change requests. These are used if roles need to be adjusted or if work must be reassigned. All changes are documented using the change request form found in **Appendix 5** and change log found in **Appendix 6**.

4.6.6 Control Resources

Control Resources is the process of ensuring that physical resources assigned and allocated to the project are available as planned and used properly (PMI, 2017). This process helps monitor resource usage, respond to changes, and take corrective actions when needed. It focuses on physical resources such as equipment, tools, and facilities. For the IVSL design project, this process helps the team manage the use of software and facilities listed in the Resource Breakdown Structure (RBS). Because the project is remote and low budget, it uses minimal physical resources. The Project Manager checks that these tools are functioning, available, and being used as planned. If there are issues with accessing or using any of the tools, the Project Manager quickly addresses the issue to avoid delays. The main tools and techniques used in this process include:

- Problem-solving when there are technical or access issues with tools and facilities.
- Alternatives analysis when exploring other options in the event a planned resource is not available or effective.

A main output of this process is work performance information, which shows how well physical resources are being used and helps identify any areas for improvement. If a resource needs to be replaced, adjusted, or added, a change request may be submitted. All

changes are documented using the change request form in **Appendix 5** and the change log in **Appendix 6**.

4.7 Communications Management Plan

Introduction

Project communications management is the process of planning, creating, sharing, managing, and monitoring information within a project (PMI, 2017). Communication is one of the most important parts of project management. Project managers spend most of their time communicating with the team and stakeholders. Good communication helps ensure that messages are clear, timely, and understood. Poor communication can lead to confusion, delays, and unmet expectations. Effective communication management supports stakeholder engagement by helping keep all parties informed and aligned with the project goals. This Communications Management Plan explains how information will be handled during the design of the Interactive Virtual Science Laboratory (IVSL). It describes what information will be shared, how and when it will be shared, and who is responsible. It explains how communication performance will be reviewed and adjusted when needed.

This Communications Management Plan supports Specific Objective 7 of the project, which is to create a Communication Management Plan to establish how project information will be shared, ensuring clear and effective communication among stakeholders. According to the PMBOK® Guide, Sixth Edition, there are three processes in project communication management:

1. Plan Communications Management
2. Manage Communications

3. Monitor Communications

These processes provide a structured approach to identifying communication needs and ensuring that information is shared effectively. This approach is especially important in the IVSL design project, where collaboration is needed between the technical team, the content development team, and key stakeholders. **Figure 25** below shows an overview of the three communication processes, including the main inputs, tools and techniques, and outputs associated with each.

Figure 25. Overview of Project Communication Management Processes

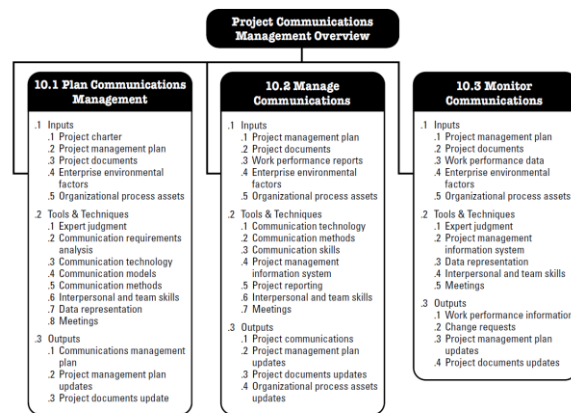


Figure 10-1. Project Communications Overview

Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* – 6th Edition, (Project Management Institute, 2017) Figure 10-1, p. 360

4.7.1 Communications Management Approach

The Communications Management Approach is the process of developing a strategy to manage project communications based on stakeholder needs and available resources (PMI, 2017). This process helps define how information will be shared as all team members in the IVSL design project will work remotely. Effective communication planning ensures

that messages are delivered clearly, at the right time, and through suitable channels. It also helps reduce misunderstandings and promotes teamwork across divisions.

The main communication objectives for this project are to:

- Ensure that stakeholders receive accurate and timely information
- Support collaboration between the technical and content teams
- Promote transparency and engagement throughout the project
- Facilitate early identification and resolution of issues

The Project Manager is responsible for coordinating all communication activities, sharing progress updates, and facilitating key meetings. The Technical Lead and Content Lead provide input and updates for their respective areas. Stakeholders will receive scheduled updates and can request clarification or provide feedback when needed. The possibility of team members from different time zones is also considered.

The main tools and techniques used in this process include:

- Communication requirements analysis – Identifies what information is needed, by whom, when, and why.
- Communication technology selection – Selecting tools suitable for remote work, such as email, messaging apps, cloud-based platforms, and video conferencing.
- Communication methods – Depending on the urgency and purpose of the message
- Interpersonal and team skills – Including cultural and political awareness

Communication methods are grouped into three main types including interactive, push, and pull communication. Interactive communication involves real-time exchange of information between parties. Push communication refers to information that is sent from one party to others without expecting immediate feedback. Pull communication refers to information that is stored in shared platforms, such as cloud folders, dashboards, or

template libraries, and accessed by project team members as needed. **Table 20** below shows the main types of communication, and the methods used for each within the IVSL design project.

Table 20. Communication Types and Methods

Communication Type	Communication Method
Interactive communication	• Video conferencing • Virtual meetings and working sessions • One-on-one check-ins • Instant messaging • Live screen sharing • Collaborative editing sessions
Push communication	• Project update emails • Progress reports • Meeting minutes • Reminders
Pull communication	• Cloud shared folders • Project dashboard • Templates and forms repository

Note. Own work.

The main output of this process is the Communications Management Plan, which includes:

- Communication objectives
- Stakeholder communication needs
- Types of communication (e.g., updates, reports, meetings)
- Communication methods and technologies
- Roles and responsibilities
- Communication frequency and timing
- Guidelines for remote and cross-time-zone coordination
- Feedback channels and performance monitoring
- Escalation procedures for communication issues

4.7.2 Manage Communications

Manage Communications is the process of creating, collecting, distributing, storing, and retrieving project information according to the Communications Management Plan (PMI, 2017). This process ensures that information flows efficiently and that stakeholders receive timely and accurate updates. In the IVSL design project all team members work remotely therefore it is essential to maintain coordination and collaboration. The Project Manager is responsible for managing communication flow throughout the project. This responsibility includes coordinating updates, facilitating stakeholder and team interactions, and ensuring proper documentation practices are followed. The Technical Lead and Content Lead provide information from their respective areas and participate in scheduled communication activities. All communication is guided by the Communications Matrix, which outlines the type, frequency, method, and responsible person for each communication task. The Communications Matrix for the IVSL design project is shown in **Table 21**.

In this process several tools and techniques are used. Communication skills such as clarity in writing and speaking, active listening, and feedback are important for ensuring that information is understood. These skills help prevent misunderstandings and support productive exchanges in meetings and written communication. They are also essential during stakeholder engagement sessions, which are conducted throughout the design process. These sessions provide space for two-way communication, allowing stakeholders to ask questions, give feedback, and stay informed. Project reporting is another key technique used to communicate progress. Formal reports, such as milestone updates, are

prepared and shared with stakeholders at agreed intervals. These reports ensure that stakeholders remain informed about project status.

Table 21. Communications Matrix

Communication Type	Purpose/Objectives	Audience	Medium	Frequency	Owner/Responsibility
Kick-off Meeting	Align team and confirm approach	Project Team	Video Conference	Once at project start	Project Manager
Weekly Check-ins	Monitor progress and coordinate tasks	Project Team	Video Call / Chat	Weekly	Project Manager
Progress Reports	Share project updates	Stakeholders	Email	Bi-weekly	Project Manager
Steering Committee Meetings	Review progress, discuss scope or risk issues, approve changes	Project Steering Committee	Video conference / In-person	At key milestones or as needed	Project Manager
Sponsor Updates	Inform sponsor of progress, risks, and strategic alignment	Project Sponsor	Email / Virtual Meeting	Monthly	Project Manager
Document Repository Access	Provide access to templates, shared drafts, and final files	Project Team	Cloud folder / Shared drive	Ongoing	Project Manager
Technical Check-ins	Align technical progress and resolve development questions	Technical Lead, Content Lead	Messaging / Collaborative tools	Weekly	Technical Lead

Design Review Sessions	Collect feedback on prototypes	Educators, Students, SMEs, Project Manager	Video Call	At milestone points	Content Lead / Tech Lead
Stakeholder Engagement Sessions	Present project updates and gather input on design features, usability, and expectations	SMEs, Educators, Students, School Administrators, Ministry of Education, ATLIB, CXC	In-person Meeting	Twice during design	Project Manager
Final Presentation	Present final design	All stakeholders	In-person or Webinar	At project end	Project Manager

Note. Own work

4.7.3 Monitor Communications

Monitor Communications is the process of making sure that all communication needs of the project and its stakeholders are being met (PMI, 2017). This process helps the team check if information is being shared clearly and on time. For the IVSL design project, since all team members work remotely, regular monitoring is especially important to keep everyone aligned and maintain progress. Communication will be monitored using the Communications Matrix found in **Table 21**. The Milestone List shown in **Table 11** serves as a reference to ensure updates are aligned with major delivery points. Several team members have roles in monitoring communication. The Project Manager leads the process and checks if information is flowing as expected. The Content Lead and Technical Lead ensure their teams are communicating effectively and report any concerns. Stakeholders may also provide feedback if communication is unclear or delayed. If issues arise, a Communications Escalation Matrix is used. This matrix, found in **Table 22** below, explains how to respond to communication problems based on their urgency. This structured process ensures that issues are addressed at the right level and within a reasonable time.

Table 22. Communications Escalation Matrix

	Priority 1	Priority 2	Priority 3
Definition	Major communication breakdown or conflict that could delay key decisions, stakeholder approval, or final deliverables.	Moderate communication delay or misunderstanding that may affect team coordination or milestone clarity.	Minor issues such as slow response or missed update with no impact on scope or timeline.

	Priority 1	Priority 2	Priority 3
Decision Authority	Project Steering Committee	Project Sponsor	Project Manager
Resolution Timeframe	Within 1 day	Within 1–2 days	Within 2–3 days
Triggers	- Breakdown in communication with Ministry of Education - Missed stakeholder engagement deadline - Public disagreement among stakeholders - Critical deliverable feedback not received	- Delayed response from Content or Technical Lead - Misalignment in project update - Stakeholder confusion during sessions	- Missed team update - Minor delay in document sharing - Clarification needed on shared content

Note. Own work

When communication problems require changes to project documents or plans, a Change Request Form must be completed. These changes are recorded in the Change Log. Both tools are found in **Appendix 5** and **Appendix 6**. Communication performance will also be reviewed by looking at meeting participation, stakeholder feedback, and whether information is received and understood. If necessary, adjustments will be made to improve how updates are shared or how frequently team members communicate.

4.8 Risk Management Plan

Introduction

Risk Management is the process of identifying, analyzing, and responding to project risks (PMI, 2017). A risk is any uncertain event or condition that could affect the project. It can be a threat that causes harm but also includes a positive opportunity that improves outcomes. The aim is to reduce the chance of negative impacts and increase opportunities for success. Risk management is important to the IVSL project to prevent delays, budget issues, or technical problems which could affect the quality of the final design. This Risk Management Plan describes the steps to identify, analyze, respond, and monitor risks.

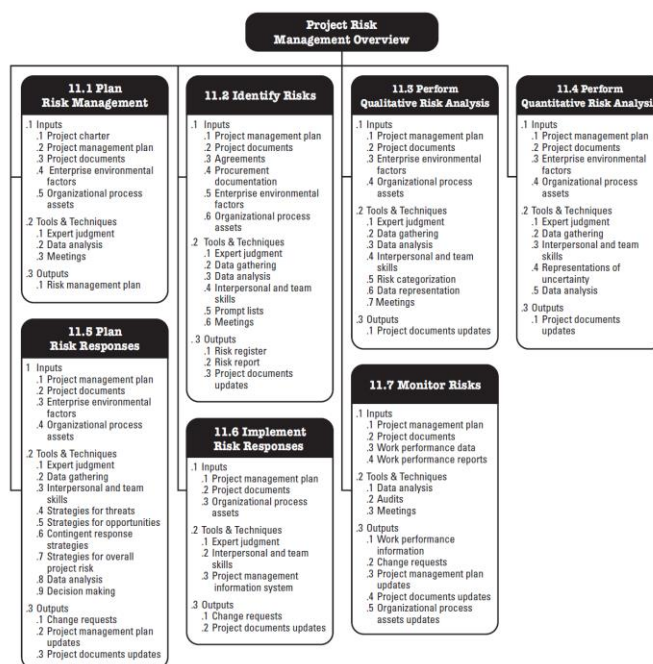
This Risk Management Plan supports specific objective 8 of the project, which is to create a Risk Management Plan to identify potential risks, assess their impact, and develop strategies to manage them. According to the PMBOK® Guide, Sixth Edition, there are seven processes in project risk management:

1. Plan Risk Management
2. Identify Risks
3. Perform Qualitative Risk Analysis
4. Perform Quantitative Risk Analysis
5. Plan Risk Responses
6. Implement Risk Responses
7. Monitor Risks

These processes help the project team plan ahead, reduce uncertainty, and manage risks that could affect the success of the IVSL design. For this project, qualitative risk

analysis is used to assess and prioritize risks based on their probability and impact. Quantitative risk analysis will not be used since the project does not involve complex numerical data. The processes Plan Risk Responses and Implement Risk Responses will be addressed together. **Figure 26** below shows an overview of these seven risk management processes, including their main inputs, tools and techniques, and outputs.

Figure 26. Overview of Project Risk Management Processes



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* – 6th Edition, (Project Management Institute, 2017) Figure 11-1, p. 396

4.8.1 Risk Management Approach

The Risk Management Approach is the process of defining how to conduct risk management activities for a project (PMI, 2017). It helps make sure that the project team uses an organized method to identify, assess, and respond to risks. The only output of this

process is the Risk Management Plan. This plan guides how risks will be handled throughout the project.

For the IVSL design project, this process is important because it sets the foundation for how risks will be managed in a remote environment. It ensures that all risks are tracked and handled properly despite having team members not working in the same physical location. It also helps the team think ahead and prepare for problems that could possibly delay the project or affect the quality of the design. The Project Manager is responsible for leading this process and preparing the Risk Management Plan. The Content Lead and Technical Lead help provide input on possible risks in their respective areas of work. The Project Sponsor and key stakeholders provide input on major concerns or risk tolerances. The Project Steering Committee may be consulted if there are changes to this plan or for serious risks that require guidance.

The Risk Management Plan includes:

- Risk categories
- Risk Breakdown Structure (RBS)
- Probability and Impact Scale
- Probability and Impact Matrix
- Risk register

4.8.2 Identify Risks

Identify Risks is the process of finding and documenting potential risks that may affect the project (PMI, 2017). The goal of this process is to understand what could go wrong, so the team can plan ahead and reduce uncertainty. Risks in the IVSL design project may occur at the individual level which affects a specific task or at the overall project level

where it could impact entire project. Risk identification is a continuous activity which should occur throughout the project as new risks appear or conditions change. To identify risks, data gathering techniques are used including brainstorming and expert judgment. The Project Manager will lead this activity with input from the Content Lead, Technical Lead, Project Sponsor, and key stakeholders. The team also uses structured tools to understand where risks may come from and how they might affect the project. SWOT analysis is used to identify risks by examining the project's internal strengths and weaknesses and its external opportunities and threats. Root cause analysis uncovers the underlying causes of potential risks. This helps the team better understand what may trigger them.

Risks are grouped using the Risk Breakdown Structure (RBS). The RBS provides a hierarchical view of risk sources. The RBS for this project is shown in **Table 23** below.

Table 23. Risk Breakdown Structure

Level 0	Level 1	Level 2
0. All Sources of Project Risk	1. Technical Risk	1.1 Content Development 1.2 Integration with learning systems
	2. Management Risk	2.1 Project Planning and scheduling 2.2 Communication and coordination 2.3 Resource availability
	3. Stakeholder Risk	3.1 Participation and feedback 3.2 Stakeholder buy-in
	4. External Risk	4.1 Internet connectivity 4.2 Availability of expert input 4.3 Access limitations

Level 0	Level 1	Level 2
		4.4 Stakeholder digital readiness 4.5 Curriculum changes

Note. Own work

All identified risks are recorded in the Risk Register which includes category, cause, consequence, probability, impact and response. The completed Risk Register is found in the Plan and Implement Risk Responses section of this management plan.

4.8.3 Perform Risk Analysis

Qualitative Risk Analysis is the process of evaluating identified risks to understand how likely they are to happen and how much they could affect the project (PMI, 2017). The main purpose is to prioritize risks, so the project team knows which ones need the most attention. Qualitative Risk Analysis is used in this project because the team is small, works remotely, and has limited data. It helps prioritize risks quickly using simple scoring methods and is more practical for the size and scope of the IVSL design project. Quantitative Risk Analysis uses simulations and statistical methods which require detailed data and will not be used in this project.

This risk analysis process involves assessing each risk based on probability and impact scales. The probability scale uses a 1 to 5 rating to show the likelihood of a risk happening: 1 = very low (less than 10% chance), 2 = low (10–30%), 3 = moderate (30–50%), 4 = high (50–80%), and 5 = very high (80–100%). The impact scale also uses a 1 to 5 rating and is based on how much risk could affect the project's schedule, cost, or quality. For example, a 5 in impact means the risk could cause a delay of more than 20%, a cost

overrun of more than 20%, or serious quality issues. The project team uses these scales to score each risk. The Probability and Impact Scale is seen below in **Table 24**.

Table 24. Probability and Impact Scale

Score	Scale	Probability	Impact		
			Schedule	Cost	Quality
5	Very High	80% - 100%	Project completion delays or accelerated by more than 20%	Cost overrun or savings exceed 20%	Severe degradation or improvement in quality
4	High	50% - 80%	Project completion delays or accelerated between 11-20%	Cost overrun or savings between 11-20%	Major impact or improvement in quality
3	Moderate	30% - 50%	Project completion delays or accelerated between 5-10%	Cost overrun or savings between 5-10%	Moderate impact or improvement to quality
2	Low	10% - 30%	Project completion delays or accelerated between 1-5%	Cost overrun or savings between 1-5%	A minor reduction or improvement in quality
1	Very Low	Less than 10%	Insignificant delay in delivery of less than 1%	Insignificant cost increase less than 1%	Negligible impact or improvement in quality

Note. Own work

The scores are plotted on a Probability and Impact Matrix found in **Figure 27** below. This matrix is a grid that helps determine the overall level of risk. Each cell in the matrix shows a score calculated by multiplying the probability rating by the impact rating. For instance, a risk with a probability of 4 and an impact of 5 would score 20. The matrix demonstrates risk severity using color zones: red for high risks (15–25), yellow for medium risks (6–12), and green for low risks (1–5). This tool, along with expert judgment, helps the team focus on risks that are most likely to affect project success. The analysis results are recorded in the Risk Register and used in the next steps of the risk management process.

Figure 27. Probability And Impact Matrix

		Threats					Opportunities						
Probability	Very High (5)	5	10	15	20	25	25	20	15	10	5	Very High (5)	
	High (4)	4	8	12	16	20	20	16	12	8	4	High (4)	
	Medium (3)	3	6	9	12	15	15	12	9	6	3	Medium (3)	
	Low (2)	2	4	6	8	10	10	8	6	4	2	Low (2)	
	Very Low (1)	1	2	3	4	5	5	4	3	2	1	Very Low (1)	
		Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)	Very High (5)	High (4)	Medium (3)	Low (2)	Very Low (1)		
Negative Impact						Positive Impact							

Note. Own work

4.8.4 Plan & Implement Risk Responses

Plan and Implement Risk Responses is the process of developing and carrying out actions to address identified risks (PMI, 2017). This process includes selecting strategies to reduce threats or enhance opportunities and ensuring these actions are actually completed. For the IVSL design project, this process is essential to keep the team prepared and responsive and is especially important since remote work and unfamiliar technologies may introduce challenges. For negative risks (threats), response strategies include:

- Avoid: Change the plan to remove the risk.
- Mitigate: Take steps to reduce likelihood or impact.
- Transfer: Assign the risk to a third party.
- Accept: Acknowledge the risk and monitor it without action unless it occurs.

For positive risks (opportunities), response strategies include:

- Exploit: Ensure the opportunity happens by assigning resources.
- Enhance: Increase the probability or benefits of the opportunity.
- Share: Collaborate with a third party to achieve the opportunity.
- Accept: Take no action but remain open to the opportunity if it arises.

The Project Manager leads this process and assigns responsibilities for carrying out risk responses. The Content Lead and Technical Lead help choose appropriate strategies for risks in their areas. Risk responses are recorded in the Risk Register found in **Table 25** below. It includes each risk, its cause, consequence, rating, strategy, and the team member responsible for managing the response. Escalation may be used when a threat or opportunity is beyond the team's control and needs action from the Project Sponsor or Steering Committee.

Table 25. Risk Register

RBS Code	Risk description	Cause	Consequence	Probability	Impact	P x I	Strategy	Owner
1.1	Content Development	Delays in drafting or reviewing lab content	Late delivery of digital content and project delays	3	4	12	Mitigate – Use a content development timeline and assign early deadlines	Content Lead
1.2	Integration with learning systems	Compatibility issues between the IVSL platform and existing school systems	Reduced access or need for technical rework	2	4	8	Mitigate – Involve IT advisors early to test and adapt	Technical Lead
2.1	Project Planning and scheduling	Underestimation of activity durations	Missed milestones or rushed work	3	3	9	Mitigate – Review schedule and use buffer time	Project Manager

RBS Code	Risk description	Cause	Consequence	Probability	Impact	P x I	Strategy	Owner
2.2	Communication and coordination	Remote work and irregular check-ins	Misunderstandings and slow task progress	3	3	9	Mitigate – Stick to weekly check-ins and clear roles	Project Manager
2.3	Resource availability	Team members balancing other jobs or delays in availability	Work is delayed or reassigned	3	2	6	Accept – Monitor availability and adjust assignments as needed	Project Manager
3.1	Participation and feedback	Low engagement from educators during design reviews	Prototypes miss key user expectations	2	4	8	Mitigate – Offer flexible meeting times	Content Lead
3.2	Stakeholder buy-in	Teachers and administrators show early enthusiasm and	Faster feedback, better alignment with user needs, and smoother	4	4	16	Exploit – Maximize this opportunity by keeping	Project Manager

RBS Code	Risk description	Cause	Consequence	Probability	Impact	P x I	Strategy	Owner
		commitment to the IVSL project	project implementation				stakeholders engaged through updates and input sessions	
4.1	Internet connectivity	Unstable or weak internet in rural areas	Interruptions in meetings and collaboration	3	3	9	Mitigate – Share materials asynchronously and record sessions	Technical Lead
4.2	Availability of expert input	Strong expert network and willingness to contribute	Timely input that improves design quality and validation	4	4	16	Enhance – Keep experts engaged with flexible input options	Project Manager
4.3	Access limitations	Stakeholders unable to access the platform due	Testing and feedback activities are slowed down	2	2	4	Mitigate – Provide early access and test accounts	Technical Lead

RBS Code	Risk description	Cause	Consequence	Probability	Impact	P x I	Strategy	Owner
		to device or login issues						
4.4	Stakeholder digital readiness	Varied comfort levels with digital tools	Frustration or slow adaptation to the virtual lab	3	3	9	Mitigate – Include simple instructions	Content Lead
4.5	Curriculum changes	Curriculum adjustments during design	Need to revise learning objectives or materials	2	4	8	Escalate – Refer major curriculum-related risks to the Steering Committee	Content Lead

Note. Own work

4.8.5 Monitor Risks

Monitor Risks is the process of tracking identified risks, identifying and analyzing new risks, and evaluating how effective the risk responses have been (PMI, 2017). This process allows risk management to remain active throughout the project and helps the team respond to changes. It also ensures that the Risk Register stays up to date as the status of risks change or new risks are identified. For the IVSL design project, risk monitoring is important because the team works remotely and relies heavily on planning and stakeholder input to stay on track.

The Project Manager is responsible for leading this process by reviewing risk statuses during weekly check-ins and milestone reviews. The Content Lead and Technical Lead are expected to report any changes in risk conditions related to their tasks. If a risk response is not working, or if a new risk emerges, the register is updated. Monitoring also includes reviewing if response actions are taken as planned. If a risk or opportunity is outside the control of the project team, the Escalation Matrix found in **Table 22** is used to determine whether to involve the Project Sponsor or Steering Committee. In cases where changes are needed, a Change Request Form found in **Appendix 5** must be completed and submitted. All changes are logged in the Change Log found in **Appendix 6**.

4.9 Procurement Management Plan

Introduction

Procurement management is the process of acquiring goods or services from outside the project team to meet project requirements (PMI, 2017). Procurement refers to any external acquisition needed to support project objectives and is especially true when internal resources or expertise are not available. For the IVSL project, procurement includes acquiring external human resources such as an instructional designer, technical lead, IT support, and subject matter experts. It also includes short-term access to physical resources like design software subscriptions, digital collaboration tools, and temporary meeting spaces.

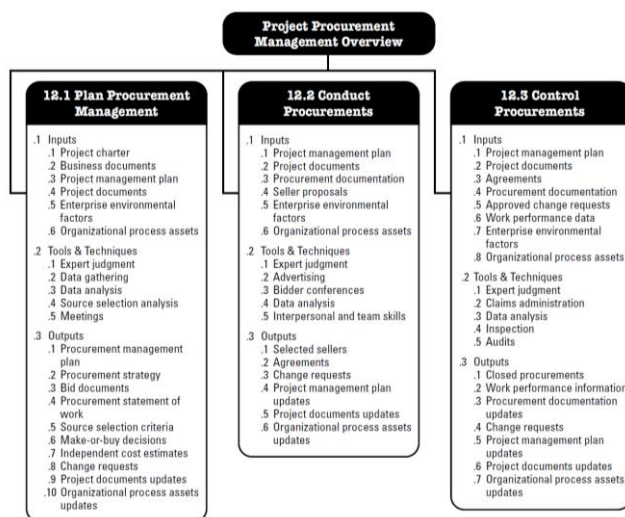
Procurement management is closely related to the Cost, Resource, Risk, and Quality Management Plans. Procurement decisions affect budget planning, resource allocation, quality assurance, and vendor risks. This Procurement Management Plan outlines how procurement will be planned, conducted, and monitored for the successful delivery of the design of the IVSL. This Procurement Management Plan supports specific objective 9 of the project which is to create a Procurement Management Plan to define the process for acquiring external resources and services required. According to the PMBOK® Guide, Sixth Edition, there are three processes in project procurement management:

1. Plan Procurement Management
2. Conduct Procurements
3. Control Procurements

These processes help the project team determine procurement needs, manage vendor selection, establish contracts, and monitor performance to ensure services are delivered as

agreed. **Figure 28** below shows an overview of the three procurement management processes, including their main inputs, tools and techniques, and outputs.

Figure 28. Overview of Project Procurement Management Processes



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* – 6th Edition, (Project Management Institute, 2017) Figure 12-1, p. 460

4.9.1 Procurement Management Approach

Plan Procurement Management is the process of documenting project procurement decisions, identifying potential sellers, and determining the approach for acquiring goods and services (PMI, 2017). This process helps make sure that all external services and tools are identified early and managed properly to support the project's goals. Competitive bidding will not be used since the project involves low-cost and short-term services and tools. Formal methods such as direct contracting and basic quote comparisons are used. Public advertising is not required due to the nature and scale of the project. The approach is selected based on the project's needs, timeline, and budget. The main contract type is the

Firm Fixed Price (FFP). In this type of contract, the cost is agreed on at the start and does not change unless the work itself changes. When hiring human resources, the project tries to prioritize local professionals to support community development and contribute to sustainable development in Belize.

The main tools and techniques used in this process include:

- Expert judgment from the Project Manager to assess service needs and vendor suitability.
- Market research to compare pricing and service features for tools and digital platforms.
- Source selection analysis to select the best approach for each procurement

The Project Manager is responsible for identifying what needs to be procured, choosing how to acquire it, and making sure it fits the project's schedule, scope, and budget. The Project Sponsor approves any major changes to the procurement strategy and provides overall guidance. Project team members help define service needs. The main output of this process is the Procurement Management Plan. This plan documents the strategy and tools that will be used to conduct and control procurements throughout the project.

4.9.2 Conduct Procurements

Conduct Procurements is the process of obtaining seller responses, selecting a seller, and awarding a contract (PMI, 2017). This process ensures that the right providers are selected to deliver services or tools that meet the project's requirements. Since the project uses direct contracting and quote comparisons, procurement begins by preparing

brief descriptions of each service to be acquired. A Statement of Work (SOW) describes the tasks, expected deliverables, timeline, and quality expectations. A Terms of Reference (TOR) is a document that explains the background, objectives, and responsibilities for more complex services. It will not be used in this project because the services are short-term and have a simple scope. Public advertising will not be used due to the limited scope and value of the procurements.

The project will not issue formal Requests for Proposal (RFP), Invitations to Tender (ITT), or formal Requests for Quotation (RFQ). However, for services such as subject matter expert (SME) review or instructional design, informal quote requests will be sent to one or more qualified providers to compare basic pricing and availability. These quotes will be reviewed based on standard selection criteria. For digital resources such as software subscriptions, online platforms, direct purchases will be made through vendor websites. These purchases will follow standard pricing and require no competitive bidding. Temporary meeting space will be acquired through direct negotiation by selecting the best and most affordable option available from local providers on the required date.

The following source selection methods will be used:

- Least cost- for digital subscriptions and online tools
- Qualifications-based selection for professional services
- Fixed budget selection- for services where the available budget is set in advance.
- Direct negotiation for cases where a service provider is selected based on trust, availability, or convenience.

Vendors will be evaluated based on the following selection criteria:

- Relevant experience in education, digital tools, or technical systems

- Price and value for money
- Availability within the project timeline
- Responsiveness during initial communication
- Familiarity with remote or virtual collaboration environments

The Project Manager leads the process of contacting potential vendors, reviewing responses, and finalizing agreements. The Project Sponsor may approve final selections if required. All selected providers are issued a basic service agreement outlining deliverables, timelines, and payment terms. The main output of this process is a list of approved vendors and their signed agreements.

4.9.3 Control Procurements

Control Procurements is the process of managing procurement relationships, monitoring contract performance, and making changes or corrections as needed (PMI, 2017). It ensures that vendors meet the terms of their agreements and that all work and payments are completed as expected. In the IVSL project, this process focuses on monitoring service contracts, software subscriptions, collaboration tools, and external purchases needed to support the design. The Project Manager keeps records of all service agreements, invoices, and communication with vendors. This record of communication confirms that deliverables are submitted on time and meet the required quality. The Project Manager also reviews deliverables against the original Statement of Work (SOW) before approving payments. Performance reviews and feedback sessions are carried out throughout the project to confirm that services meet expectations and to identify any issues early. For digital tools and subscriptions, the purchase is considered complete once payment is

confirmed and access is granted. For the temporary meeting space, the service is considered complete once the booking is confirmed, payment is made, and the space is used as planned on the scheduled date.

If issues come up such as delays, poor quality, or miscommunication, the Project Manager first follows up with the vendor to clarify expectations or adjust the delivery timeline. If a service cannot be completed as planned, the vendor may be replaced with another one offering the same service. This is only provided that the cost, timeline, and scope remain more or less the same. These small changes will be documented, but do not need a formal change request. However, if the change affects the project's cost, schedule, or scope, a Change Request Form is completed and submitted using the form found in **Appendix 5**. Changes are recorded in the Change Log found in **Appendix 6**. If an issue cannot be resolved by the Project Manager, it follows the process explained in the Escalation Matrix found in **Table 22**.

4.10 Stakeholder Management Plan

Introduction

Stakeholder management is the process of identifying people, groups, or organizations that could affect or be affected by the project. It also includes developing strategies to engage them effectively (PMI, 2017). Stakeholders include anyone with an interest in the project's outcome. In the IVSL project, key stakeholders include students, teachers, administrators, subject matter experts, and members of the project team. These individuals influence the project's design, provide feedback, and help ensure the design reflects educational needs and teaching goals.

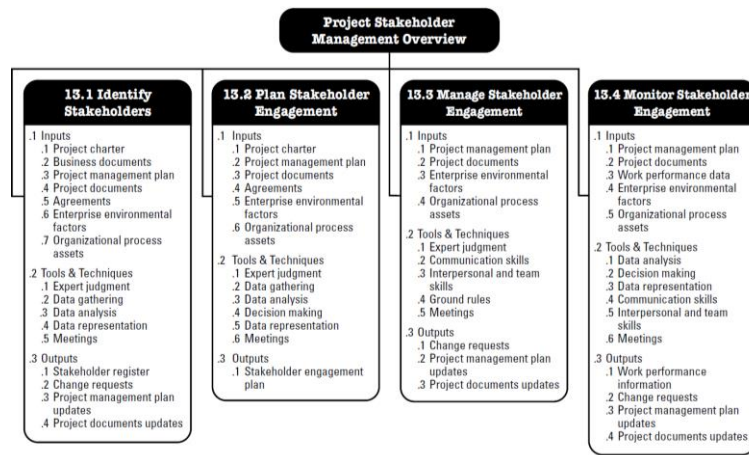
The Stakeholder Management Plan describes how stakeholders will be identified, analyzed, engaged, and monitored throughout the project. It supports the last specific objective of the project, which is to create a Stakeholder Engagement Plan to identify key stakeholders and define how they will be engaged throughout the project. According to the PMBOK® Guide, Sixth Edition, there are four processes in project stakeholder management:

1. Identify Stakeholders
2. Plan Stakeholder Engagement
3. Manage Stakeholder Engagement
4. Monitor Stakeholder Engagement

These processes help the project team communicate clearly and build strong relationships with stakeholders. Stakeholder engagement connects with every other management plan as feedback from stakeholders plays a central role in shaping the design

of the IVSL. **Figure 29** below shows an overview of the stakeholder management processes, including their main inputs, tools and techniques, and outputs.

Figure 29. Overview of Project Stakeholder Management Processes



Note. Adapted from *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* – 6th Edition, (Project Management Institute, 2017) Figure 13-1, p. 504

4.10.1 Identify Stakeholders

Identify Stakeholders is the process of identifying all people or organizations who may be affected by the project, and documenting relevant information about their interests, involvement, and impact (PMI, 2017). This step is important because it helps the project team understand who should be informed, consulted, or involved at different stages of the project. In the IVSL project, identifying stakeholders early helps ensure they are engaged appropriately, and feedback is collected effectively. A total of 11 key stakeholders or stakeholder groups are identified based on their connection to the IVSL design. These include internal team members, subject matter experts, students, educators, administrators,

and institutional partners. These individuals or groups vary in their level of power over project decisions and their interest in the design of the IVSL.

A Stakeholder Register is created to record key information, including name or group, category, functional area, roles and responsibilities, level of power, and level of interest. Power refers to the stakeholder's ability to influence the project, and interest refers to how much they care about the outcome. A three-point scale is used to classify each stakeholder's level of power and interest as high, medium, or low. The Stakeholder Register helps the project team plan how to engage each person or group and is shown in **Table 26** below. It is a dynamic document which is updated throughout the project in the event new stakeholders are identified or if existing stakeholder roles, power, or interest levels change.

Table 26. Stakeholder Register

ID	Stakeholder	Category	Functional Area	Role and Responsibilities	Power	Interest
1	Project Sponsor	Internal	Governance	Oversee the project's funding, scope, and alignment with strategic goals.	High	High
2	Steering Committee	Internal	Governance	Provide strategic guidance, approve key decisions, and support risk mitigation.	High	Medium
3	Project Manager	Internal	Project Management	Lead the planning and execution of the IVSL project and coordinate	High	High

ID	Stakeholder	Category	Functional Area	Role and Responsibilities	Power	Interest
				all stakeholder activities.		
4	Project Team Members	Internal	Execution	Contribute to the design of the IVSL through assigned tasks.	Low	High
5	Subject Matter Experts (SMEs)	External	Academic Review	Contribute scientific and technical expertise to ensure content accuracy and functional quality of the IVSL.	Low	Low
6	Science Educators	External	Instruction	Provide input and feedback on design of the IVSL with reference to classroom relevance and alignment with curriculum.	Low	High
7	Students	External	End Users	Serve as end users of the IVSL, providing feedback on usability and engagement, and helping evaluate its effectiveness for science learning.	Low	High

ID	Stakeholder	Category	Functional Area	Role and Responsibilities	Power	Interest
8	School Administrators	External	Academic Management	Provide school-level support and ensure that the IVSL aligns with institutional policies and teaching priorities.	High	Medium
9	Ministry of Education	External	Policy/Regulatory	Offer policy-level oversight, ensure educational compliance.	High	Medium
10	Association of Tertiary Level Institutions in Belize (ATLIB)	External	Higher Education Coordination	Represent the interests of tertiary institutions.	Medium	Medium
11	Caribbean Examinations Council (CXC)	External	Curriculum and Assessment	Ensure alignment with CXC science syllabi and support for practical assessment standards.	Medium	Medium

Note. Own work

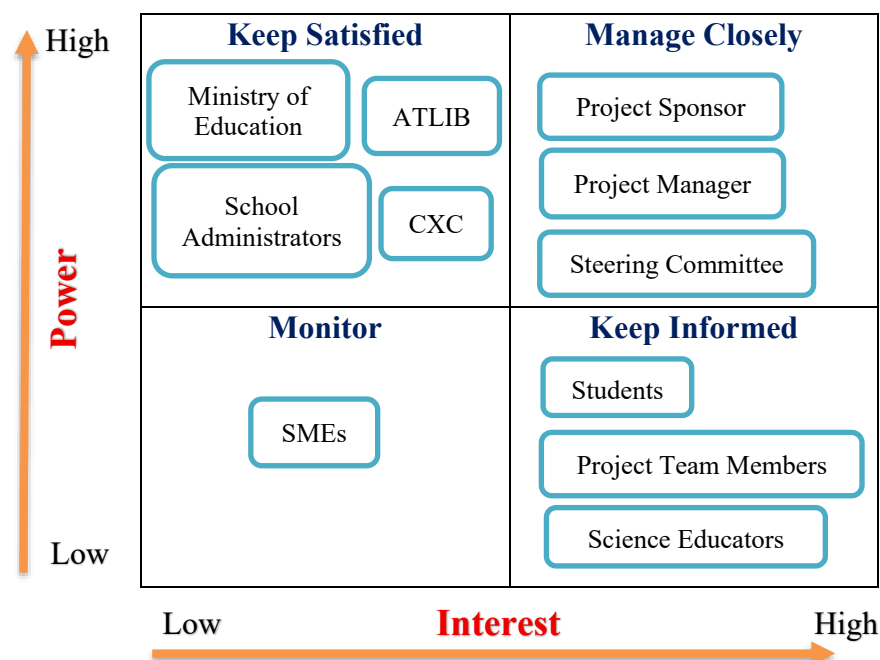
4.10.2 Plan Stakeholder Engagement

Plan Stakeholder Engagement is the process of developing strategies to involve stakeholders based on their needs, expectations, influence, and level of interest in the project (PMI, 2017). This helps the project team decide how to work with each stakeholder group and keep them engaged throughout the project. For the IVSL project, this process is important because stakeholder input directly affects the design and usefulness of the virtual lab. Engaging the right people at the right time ensures that the design meets classroom needs and is accepted by educators, students, and institutional partners. Some stakeholders need regular updates and involvement, while others only need occasional communication. To help organize this, stakeholders are grouped using the Power Interest Matrix based on how much influence they have on the project and how much they care about its results. The matrix includes four categories:

- High power, high interest stakeholders are placed in the manage closely group. These individuals are highly involved in decisions and should be engaged regularly.
- High power, low interest stakeholders are placed in the keep satisfied group. They should be consulted at major milestones, but they do not need constant updates.
- Low power, high interest stakeholders are placed in the keep informed group. The feedback of these stakeholders is valuable, even though they do not control decisions.
- Low power, low interest stakeholders are placed in the monitor group. These individuals need minimal involvement, but they are still kept in the loop when needed.

This classification helps the project team decide how much communication is needed for each group. The stakeholder power interest matrix for the IVSL project is shown in **Figure 30** below.

Figure 30. Stakeholder Power Interest Matrix



Note. Own work

The Project Manager leads all stakeholder engagement activities, keeps track of communication needs, and updates the plan if needed. The Project Team helps by sharing project updates and collecting input from key stakeholders. This plan also works closely with the Communications Management Plan, which explains how often each stakeholder will be contacted and what kind of communication will be used. The key output of this process is the stakeholder engagement plan which is a guide of how stakeholders are communicated with and followed up with during the design of the IVSL.

The stakeholder engagement plan includes the following:

- Stakeholder Register
- The Power Interest Matrix
- The engagement strategies and communication methods
- Approach for managing and monitoring stakeholder engagement
- Stakeholder Engagement Assessment Matrix

4.10.3 Manage Stakeholder Engagement

Manage Stakeholder Engagement is the process of working with stakeholders to meet their needs, address concerns, and keep them involved in the project (PMI, 2017). This helps build trust and improve collaboration. Managing stakeholder engagement properly ensures that the IVSL design reflects the input of those who will use or support it. For this project, this process focuses on keeping key stakeholders informed, involved, and engaged throughout the design. The Project Manager leads stakeholder engagement activities and makes sure communication happens as outlined in the Communications Management Plan. These activities include check-ins, surveys, forms, stakeholder engagement sessions, interviews, meetings, and discussions. These activities help ensure that feedback is gathered in a structured way. Project Team Members support this work by responding to stakeholder input and helping build positive working relationships. **Table 27** below outlines the engagement strategy and mode of communication used for each stakeholder group.

Table 27. Stakeholder Engagement Communication Methods

Stakeholder	Engagement Strategy	Mode(s) of Communication
Project Sponsor	Manage Closely	Virtual meetings, email updates, final presentation
Steering Committee	Keep Satisfied	Steering meetings (virtual), reports, final presentation
Project Manager	Manage Closely	Ongoing coordination, weekly updates, final presentation
Project Team Members	Keep Informed	Weekly check-ins, cloud document access, final presentation
Subject Matter Experts	Monitor	Email, document review comments, final presentation
Science Educators	Keep Informed	Stakeholder engagement sessions (in-person), final presentation
Students	Keep Informed	Feedback forms, stakeholder engagement sessions (in-person), final presentation
School Administrators	Keep Satisfied	Stakeholder engagement sessions (in-person), final presentation
Ministry of Education	Keep Satisfied	Stakeholder engagement sessions (in-person), final presentation
ATLIB	Keep Satisfied	Stakeholder engagement sessions (in-person), final presentation
CXC	Keep Satisfied	Stakeholder engagement sessions (in-person), final presentation

Note. Own work

Stakeholder engagement is based on the assumption that individuals are willing to share their needs and feedback to improve the quality of the design. The Project Manager and team use communication skills such as active listening, cultural awareness, and careful observation to build good relationships and avoid misunderstandings. When misunderstandings do occur, the Project Manager will try to resolve them through informal conversations or by referring to the scope and goals. If an issue cannot be resolved easily, it follows the escalation steps in the Communications Management Plan. If new stakeholders are identified or if changes in engagement activities affect the scope, schedule, or cost, a Change Request Form is completed and submitted using the template in **Appendix 5**. Changes are added to the Change Log found in **Appendix 6**.

4.10.4 Monitor Stakeholder Engagement

Monitor Stakeholder Engagement is the process of tracking stakeholder relationships and making sure engagement strategies are working as planned (PMI, 2017). This helps the project team stay aware of any issues and adjust communication if needed. For the IVSL project, this process focuses on checking whether stakeholders are still involved, interested, and supportive as the design of the virtual lab continues. The main monitoring tool used for this process is the Stakeholder Engagement Assessment Matrix. This matrix compares the current level of engagement to the desired level for each stakeholder or stakeholder group. If a gap is found, the Project Manager adjusts how information is shared. This may involve increasing or decreasing communication or changing the communication method. These actions help move engagement from its current state to the desired state. The Stakeholder Engagement Assessment Matrix for the design of

the IVSL project is found below in **Table 28**. The levels of engagement used in the table include:

- Unaware- Unaware of the project and potential impacts.
- Resistant- Aware of the project and potential impacts but resistant to any changes that may result.
- Neutral- Aware of the project, but neither supportive nor unsupportive.
- Supportive- Aware of the project and potential impacts and supportive of the work and its outcomes.
- Leading- Aware of the project and potential impacts and actively engaged in ensuring that the project is a success.

Table 28. Stakeholder Engagement Assessment Matrix

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Project Sponsor					C,D
Project Steering Committee				C	D
Project Manager					C,D
Project Team Members				C	D
Subject Matter Experts	C			D	
Science Educators	C			D	

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Students	C			D	
School Administrators	C			D	
Ministry of Education	C			D	
ATLIB	C			D	
CXC	C			D	

Note. Own work

Monitoring stakeholder engagement needs to happen throughout the project to make sure communication stays effective and stakeholders stay involved. This process depends on skills such as feedback, presentation, active listening, cultural and political awareness. These skills help the team understand how stakeholders react and feel about the project. Stakeholder engagement is checked during weekly check-ins, design reviews, and project updates. If any changes to engagement strategies are needed, they are first discussed with the Project Manager. If the change could affect the scope, schedule, or cost of the project, a Change Request Form is completed and submitted using the template found in **Appendix 5**. Changes are added to the Change Log found in **Appendix 6**. Keeping stakeholders engaged throughout the projects ensures the IVSL design continues to reflect the needs of users and supporting institutions.

5 CONCLUSIONS

The project achieved its general objective by developing a structured Project Management Plan to guide the design of an Interactive Virtual Science Laboratory (IVSL). The plan addressed key science educational challenges in Belize by applying project management practices. It offered practical solutions to improve learning outcomes, enhance accessibility for remote and online students, reduce student stress, and minimize the time teachers spend grading lab reports. Each component was carefully designed using tools, templates, and techniques recommended by the Project Management Institute (PMI). The plan addressed the following knowledge areas: Scope, Schedule, Cost, Quality, Resource, Communications, Risk, Procurement, and Stakeholder Management. Based on the specific objectives established, the following conclusions were drawn:

1. The Project Charter established the project's foundation by formally authorizing its initiation and aligning it with Catalyst Educational Services' mission. It clearly defined the general and specific objectives, outlined the project's justification, and identified key deliverables. The charter also presented the general budget, major milestones assumptions, and restrictions and that would guide project planning.
2. The Scope Management Plan was developed to describe how the scope of the IVSL would be defined, validated, and controlled to meet stakeholder expectations. Several tools were used to establish the scope, including the Scope Statement, Requirements Traceability Matrix, WBS, and WBS Dictionary. These tools helped organize the project work and align it with stakeholder needs. The plan also included a formal process for reviewing and approving scope changes.

3. The Schedule Management Plan was developed to outline how the activities for designing the IVSL would be defined, sequenced, and tracked to ensure timely completion. Microsoft Project was used to prepare key tools such as the activity list, milestone list, Gantt chart, and critical path diagram. These tools helped visualize the workflow and identify the sequence of tasks that determine the project's duration. A formal change control process was also included to manage updates and maintain alignment with the project timeline.
4. The Cost Management Plan was developed to describe how the project's financial resources would be planned, estimated, and controlled to keep the design of the IVSL within budget. It included the cost estimate, budget, cost baseline, and reserves. Tools such as bottom-up estimating, reserve analysis, and Earned Value Management (EVM) were used to track cost performance. Microsoft Excel and Microsoft Project helped calculate and visualize planned versus actual spending. The plan also outlined how changes would be reviewed and approved using the Change Request Form and logged for tracking.
5. The Quality Management Plan was developed to define the standards, processes, and responsibilities needed to ensure that the IVSL design met educational and technological expectations. It included quality metrics, quality checklists, an internal audit form, and an inspection report log to support quality assurance and control. The plan used stakeholder input, benchmarking, and the MoSCoW method to prioritize and validate requirements. Quality was integrated throughout the project using the PDCA cycle and regular inspections.
6. The Resource Management Plan was developed to define how team members and physical resources would be identified, assigned, and managed for the IVSL design.

It included tools such as the Organizational Breakdown Structure (OBS), Resource Breakdown Structure (RBS), and RACI matrix to clarify roles, responsibilities, and resource needs. These tools helped ensure that the right people and tools were available to complete the work on time and within budget.

7. The Communications Management Plan was developed to ensure project information was shared clearly and efficiently among stakeholders. It included a Communications Matrix to define what would be shared, with whom, and how often, and an Escalation Matrix to manage urgent issues. The plan also outlined communication methods like interactive, push, and pull formats based on stakeholder needs.
8. The Risk Management Plan was developed to identify, analyze, and manage uncertainties that could affect the IVSL project. It included the Risk Breakdown Structure (RBS), Probability and Impact Scale, Probability and Impact Matrix, and a Risk Register to record key details such as risk category, cause, consequence, rating, strategy, and owner. Qualitative analysis was used to score risks and prioritize.
9. The Procurement Management Plan was developed to define how external goods and services would be acquired to support the IVSL design. It outlined procurement methods such as direct contracting, quote comparison, and vendor evaluation using selection criteria. Firm Fixed Price (FFP) contracts were preferred to control costs and reduce complexity. The plan stated that a Statement of Work (SOW) would be developed for each service to outline deliverables and expectations.
10. The Stakeholder Management Plan was developed to identify, analyze, and engage key individuals and groups who influence or are affected by the IVSL. It included a Stakeholder Register and used the Power-Interest Matrix to group stakeholders

based on their influence and level of concern. The plan also outlined strategies for managing and monitoring stakeholder engagement through interviews, feedback forms, and engagement sessions. A Stakeholder Engagement Assessment Matrix was used to compare current and desired engagement levels.

6 RECOMMENDATIONS

1. The Project Manager should make sure the approved Project Charter is followed throughout the project and that any changes go through the change control process. The Project Sponsor should review the Charter at each major phase to confirm that the project still supports the goals of Catalyst Educational Services.
2. The Project Manager should ensure that the Scope Baseline is reviewed and approved by the Project Sponsor and Steering Committee to avoid scope creep. The Requirements Traceability Matrix should be used to confirm that each design element directly responds to stakeholder requirements. If any changes to scope arise during the design process, they should be documented and evaluated through the established change request procedure.
3. The Project Manager should use the Gantt chart, milestone list, and activity list to monitor progress and keep the design of the IVSL on track. The team should follow the number of days assigned to each activity in the Schedule Baseline to help ensure the project is completed on time. If delays affect tasks on the critical path, the Project Manager should inform the Steering Committee so that decisions can be made quickly. All delays should also be reported to the Project Manager as soon as possible.
4. The Project Manager should use Microsoft Excel and MS Project to track actual costs against the Cost Baseline throughout the design of the IVSL. Before starting any procurement activities, cost estimates should be reviewed with the Technical Lead and Instructional Designer. It is also recommended that cost performance be checked monthly using Earned Value Management (EVM) to identify any major

variances early. If significant cost changes are found, the Project Manager should log them and follow the formal change control process.

5. The Education & Content Lead should use the quality checklist and audit form to review all lab design materials, including simulations and instructional content, before they are finalized. The Project Manager should ensure that the inspection report log is used to track findings and follow-up actions throughout the design phase. It is also recommended that the Education & Content Lead consult the Ministry of Education, CXC, and ATLIB on guidelines to ensure that the virtual lab aligns with national and regional academic standards.
6. The Project Manager should ensure that the RACI matrix stays updated if any team roles or responsibilities change during the design of the IVSL. The Technical Lead should advise the Project Manager if new tools, platforms, or technical support needs arise. The Education & Content Lead may also advise on any additional instructional or content-related resources needed to support the design process. If any planned resources become unavailable, adjustments should be made quickly to avoid disruptions and maintain team coordination.
7. The Project Manager should ensure that communication remains clear and consistent across all team members and stakeholders during the IVSL design, especially since the project team works remotely. Weekly check-ins and scheduled progress updates should be maintained as outlined in the Communications Matrix. If any delays or miscommunications occur, the Escalation Matrix should be followed to ensure concerns are addressed at the right level and within the expected time.

8. The Project Manager should review and update the Risk Register weekly to ensure all potential threats to the IVSL design are tracked and addressed. The Project Team should remain alert to new risks and inform the Project Manager so that they can be properly assessed and documented. Significant risks that could impact the project's timeline, cost, or quality should be escalated to the Steering Committee. All risk response strategies should be realistic and based on available resources.
9. The Project Manager should prepare a clear Statement of Work (SOW) for each service to be procured, outlining deliverables, timelines, and responsibilities. The Steering Committee should review vendor selection using the source selection criteria to ensure fairness, value, and accountability. It is also recommended that each contract be reviewed by a legal advisor to prevent misunderstandings or legal issues.
10. The Project Manager should use the Stakeholder Engagement Assessment Matrix to monitor stakeholder involvement throughout the IVSL design process. Engagement strategies should be updated as needed based on feedback from surveys, interviews, and stakeholder engagement sessions. Stakeholder involvement should remain a shared responsibility among the Project Team. The Project Sponsor and Steering Committee should help to support engagement at higher levels.

7 VALIDATION OF THE FGP IN THE FIELD OF REGENERATIVE AND SUSTAINABLE DEVELOPMENT

Today, development is understood as more than just economic growth. It now includes caring for people, the environment, and creating long-lasting success. This shift has made sustainable and regenerative development important concepts in project management. Sustainable and regenerative development help guide how projects are planned and carried out so that they create lasting benefits for both communities and ecosystems. Sustainable development is defined as development that meets present needs without harming the ability of future generations to meet theirs (United Nations, 1987). It is commonly known as zero harm. This type of development balances social, environmental, and economic factors. To help support this type of development, the United Nations created the Sustainable Development Goals (SDGs). These 17 goals provide a framework for ending poverty, protecting the planet, and promoting peace, equity, and prosperity for all by 2030 (United Nations, 2015). These goals are used by governments, companies, and project teams.

Regenerative Development goes a step beyond traditional sustainability. Regenerative development focuses not only on avoiding harm but also on repairing and improving damaged systems. It is based on the idea that humans are part of nature, and their actions should help improve it. Regenerative development considers six dimensions: environmental, social, economic, political, cultural, and spiritual (Müller, 2021). These dimensions can help guide project teams to create not just sustainable, but also regenerative outcomes that support the well-being of both people and ecosystems.

The PMBOK® Guide 7th Edition (PMI, 2021) introduced 12 fundamental project management principles as discussed in Chapter 2. Among these, three principles stewardship,

systems thinking, and value delivery are especially relevant to sustainable and regenerative development. Stewardship means managing resources responsibly and ethically. It supports sustainability by encouraging decisions that protect people and the planet not only now but also in the future. Systems thinking helps project managers see how a project connects to larger social, environmental, and economic systems. It helps them understand that their project is part of something bigger and the role it plays in the effort toward sustainability and regeneration. Value delivery is about creating long-term benefits for all stakeholders. In sustainable projects, this means delivering long-term benefits that are also good for the people, the environment, and the economy.

To support these efforts, several frameworks have been developed to help project teams apply sustainability and regeneration principles. One key example is the P5 Standard from Green Project Management (GPM). This standard looks at five impact areas which include product, process, people, planet, and prosperity and encourages project managers to assess and improve sustainability efforts in those five areas (GPM Global, 2020). The P5 Standard uses a supporting tool called the P5 Impact Analysis (P5IA). This tool helps teams identify risks and opportunities linked to sustainability and include responsible actions in how they plan and carry out the project.

The importance of sustainability in project work continues to grow. A 2024 report by GPM found that 43% of projects around the world have experienced major disruptions due to sustainability issues like resource shortages and environmental regulations (GPM Global, 2024). This shows that sustainability is not just a good idea. It is now an important part of project success and risk management. This is especially true for projects like this Final Graduation Project which involves designing an Interactive Virtual Science Laboratory. This

type of project promotes access to education while using fewer resources and reducing carbon footprint.

7.1 Relationship of the project to the Sustainable Development Goals.

The Sustainable Development Goals (SDGs) are 17 global goals adopted by the United Nations in 2015 as part of the 2030 Agenda for Sustainable Development. These goals aim to reduce poverty, protect the environment, and promote peace and prosperity for all (United Nations, 2015). Projects around the world are encouraged to align with these goals in order to contribute to long-term, positive change (Carboni et al., 2024). This project, designing an Interactive Virtual Science Laboratory, supports many of these goals. Below is a description of each SDG, its purpose, and how this project supports it through its design and possible development and implementation.

- SDG 1 is no poverty. This goal aims to end poverty everywhere. The virtual lab helps by reducing education costs. Students no longer need to pay for travel, lab materials, or extra fees to attend physical labs. This makes it easier for low-income students to continue their science education and improve their future opportunities.
- SDG 2 is zero hunger. This goal focuses on ending hunger and promoting good nutrition. While the lab is not directly about food, it supports science learning, which can inspire students to explore careers in agriculture, nutrition, or food technology. This could lead to future solutions for food-related challenges.
- SDG 3 is good health and well-being. This goal promotes healthy lives for all. The virtual lab provides a safer way to learn science by reducing exposure to chemicals or physical lab accidents. It also supports mental well-being by offering flexibility and reducing the stress that comes with traveling or tight lab schedules.

- SDG 4 is quality education. This goal is about making education accessible, fair, and high quality. The virtual lab supports this goal directly by making science labs available to more students, including those in remote areas. It helps students learn in an engaging way, at their own pace, and without the usual barriers of location or cost.
- SDG 5 is gender equality. This goal works to give equal opportunities to women and girls. The virtual lab supports this by allowing more flexible learning, which is helpful for women and girls who may face challenges attending in-person classes. It gives them a better chance to study science and succeed in STEM fields.
- SDG 6 is clean water and sanitation. This goal is to protect water and make sure everyone has access to clean water. Traditional science labs often use a lot of water for cleaning and experiments. They also produce chemical waste that may be disposed of improperly, harming water sources. The virtual lab helps reduce water use and protects water quality.
- SDG 7 is affordable and clean energy. This goal focuses on making energy use more efficient and increasing the use of renewable energy. While the virtual lab still needs electricity to run, it uses less energy than running a physical lab with lights, equipment, and air conditioning. While the design may not increase the use of renewable energy per se, it significantly decreases the amount of electricity consumed.
- SDG 8 is decent work and economic growth. This goal promotes inclusive and sustainable economic growth, employment, and decent work for all. The virtual lab

supports this goal by helping students gain science skills that can lead to better job opportunities in the future.

- SDG 9 is industry, innovation and infrastructure. This goal focuses on building resilient infrastructure, promoting innovation, and supporting sustainable industries. The IVSL is an example of educational innovation that uses technology to improve learning. It reduces costs by offering a virtual alternative to traditional science labs.
- SDG 10 is reduced inequalities. This goal works to reduce inequality within and among countries. The virtual lab allows students in remote, rural, or low-income areas to access the same quality of science education as others, helping to close the education gap and promote equal opportunities for learning and advancement.
- SDG 11 is sustainable cities and communities. This goal aims to make cities and communities safe, inclusive, and sustainable. The IVSL reduces the need for student travel, which can reduce carbon emissions and support more flexible learning environments. It also makes education more accessible within communities that lack science lab facilities.
- SDG 12 is responsible consumption and production. This goal encourages the efficient use of resources and reducing waste. Virtual labs eliminate the need for disposable materials like glassware, chemicals, and paper worksheets. This reduces solid waste, chemical waste, and overconsumption.
- SDG 13 is climate action. This goal is to take action to combat climate change. The IVSL helps lower greenhouse gas emissions by reducing the need for student transportation and energy use in physical labs. Using digital tools for education supports a lower-carbon future.

- SDG 14 is life below water. This goal focuses on protecting oceans and marine life. Although the lab is not directly related to marine environments, it supports this goal indirectly by reducing the risk of chemical spills and runoff from physical lab activities that could pollute water bodies. Belize is a country bordered by the Caribbean Sea and home to many rivers and lagoons. For this reason, it is especially important to reduce the risk of chemical waste entering water systems.
- SDG 15 is life on land. This goal is to protect ecosystems, forests, and biodiversity on land. By reducing the need for physical materials and harmful chemicals, the IVSL supports cleaner practices that help protect natural ecosystems from lab-related waste and contamination.
- SDG 16 is peace, justice and strong institutions. This goal promotes peaceful societies, access to justice, and strong institutions. The IVSL contributes to this goal by supporting inclusive and fair education. It gives all students regardless of location or background a chance to learn. This helps to build trust in educational systems.
- SDG 17 is partnerships for the goals. This goal is about strengthening partnerships between governments, businesses, and communities to achieve the SDGs. The virtual lab has the potential to connect schools, teaching faculty and internet providers. These connections can expand the access to science education to improve quality and even reduce costs.

7.2 Analysis of the project according to Standard P5

The P5 Standard was created by Green Project Management (GPM). It is a framework that helps project teams look at how their projects affect sustainability. P5

stands for product, process, people, planet, and prosperity. These five areas cover the environmental, social, and economic impacts a project may have during its life cycle (GPM Global, 2020). The P5 Standard includes categories, subcategories, and specific elements under each impact area. The main tool used in this framework is called the P5 Impact Analysis (P5IA). It helps project teams identify the positive and negative effects their project might have. The tool is designed to support teams from the beginning of the project. It helps them make better decisions and align their work with sustainability goals.

To complete a P5 Impact Analysis, the team analyzes the project life cycle from planning to completion and lists possible situations that might affect sustainability. After identifying those situations, they describe what might cause them and what effects they could have. Each one is given a score to show how strong the impact might be. The scores range from 1-5 with 1 being severe negative impact, 2 being negative impact, 3 being neutral, 4 being positive impact and 5 being strong positive impact. The team then suggests actions that could help reduce any harm or increase the benefits. After planning these changes, they give a new score to show the expected results if the improvements are made (GPM Global, 2020). The before and after scores are useful because they allow the team to clearly see if their actions are making a difference. The goal is not just to avoid doing harm, but to create more value in each of the five areas. This helps make the project regenerative.

The P5 Impact Analysis looks at projects from two main perspectives, product and process. It uses five specific lenses to examine these perspectives. For the product, it uses the lenses of Lifespan and Servicing. Lifespan refers to how long the product or solution remains useful. Servicing looks at how easily it can be maintained or reused. For the process, the lenses are efficiency, effectiveness, and fairness. Efficiency examines how well resources are used. Effectiveness focuses on how well the project meets its goals. Fairness

looks at how just and inclusive the project is for all stakeholders involved. These five lenses help ensure that nothing important is overlooked and that both short-term and long-term sustainability impacts are considered (GPM Global, 2020).

This type of analysis is very important because it puts sustainability at the center of project management. Instead of being an extra task, sustainability is considered in every step of the project. The P5IA also helps connect the project to the United Nations Sustainable Development Goals (SDGs) which we previously mentioned. Both aim to improve life for people and the planet. Using the P5IA has many benefits. It helps teams increase the long-term positive results their project can bring. It also helps them reduce harm to people, the environment, or communities. The tool is thorough and detailed; it allows project teams to examine many areas of a project that might otherwise be overlooked. It is a reflective and thoughtful process that encourages careful analysis. This leads to responsible decision-making at every stage of the project.

For this Final Graduation Project, which is a Project Management Plan for designing an Interactive Virtual Science Laboratory, the P5 Impact Analysis is especially helpful. It shows how the lab can reduce waste, use less energy, and make science learning more accessible to students in different locations. It also helps identify areas of improvement so all students can benefit equally. By completing this analysis, the project becomes more than an innovative idea. It becomes a sustainable alternative that is fair and is working towards creating a better future.

A P5IA was done for this project. The analysis for the people, planet, and prosperity impacts can be found in **Table 29, 30, 31** below. **Table 32** is a scoring summary of the three impacts.

Table 29. People Impacts

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
Subcategory	Labor Practices and Decent Work									
Element	Definition									
 Employment and Staffing	Employment and staffing is the process of obtaining the personnel needed to carry out the project. It includes identifying the skills required for successful completion of the project, recruiting potential individuals (internally or externally), managing their time and performance, training them when needed, and compensating them accordingly.	Lifespan	Yes	The project hires contract-based staff (e.g., designers, educators) for short-term roles focused only on the lab design phase.	Does not provide long-term employment or stable income for team members, reducing potential for sustainable livelihoods.	3	Offer contract extensions for high performers and plan follow-up roles in future projects	4	1	May create stable roles if the business expands.
		Servicing	Yes	The people hired are only involved during the design phase. There are no roles planned to maintain or support the lab later.	Without continued involvement, it is harder to keep the knowledge in the team and support future work.	3	Assign flexible or part-time roles to help with future updates and document processes clearly.	4	1	Creating handover documents can help new people work more easily in the future.
		Effectiveness	Yes	Some people might not have strong enough skills in science or digital learning design.	If the team lacks the right skills, the lab may not work well or help students learn properly	3	Hire people who have experience in science education and creating digital learning tools.	5	2	This improves learning quality and benefits teachers and students using the lab.
		Efficiency	Yes	A small team is doing many tasks, which can lead to stress or missed deadlines.	Overworked staff may feel burned out, making the project slower or less productive.	3	Use clear task lists and planning tools to share work fairly and avoid overload.	4	1	A RACI chart will help show who is responsible for each task.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
		Fairness	Yes	Hiring is fair and open but mostly done through personal networks or informal outreach.	This could leave out qualified people who don't hear about the job, reducing fairness and inclusion.	4	Post job openings publicly and reach out to a wider group of candidates.	5	1	This helps ensure everyone has an equal chance to apply and take part.
 Labor Management Relations	Labor/management relations in the project context means building trust, understanding, and cooperation among project and other managers, organizational staff, and project team members. It involves respecting each other's opinions, resolving conflicts proactively, communicating clearly, and ensuring that everyone is aware of their roles and responsibilities.	Lifespan	Yes	The project team only works together during the design phase, which may limit the chance to build long-term relationships.	This makes it harder to build trust and teamwork that can last beyond the project.	3	Encourage collaboration through follow-up projects and ongoing communication even after delivery	4	1	Maintaining a professional network may help if the team reunites for future projects.
		Servicing	Yes	Team members may not interact often outside of meetings, especially since they are working remotely and part-time.	Poor ongoing communication could lead to misunderstandings or confusion about tasks.	3	Schedule regular virtual check-ins and use shared communication platforms (e.g. Teams).	4	1	Communication tools will help create a sense of connection and shared understanding.
		Effectiveness	Yes	If roles and responsibilities are not clearly explained, tasks may be duplicated or missed.	This could cause delays or errors, reducing the quality and success of the lab design.	3	Use a RACI chart and onboarding documents to explain who is responsible for what	5	2	Clear task assignments reduce mistakes and improve teamwork.
		Efficiency	Yes	Misunderstandings or unclear feedback can lead to rework or delays.	Time and resources may be wasted if there is not clear, respectful	3	Set up simple feedback loops and clarify communication	4	1	Having a feedback plan can prevent avoidable issues.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
			Yes		communication among team members		rules (who to go to for what).			
		Fairness		As a small and fast-moving project, decisions may be made quickly without fully including all team voices	This may make some team members feel left out or undervalued, affecting morale and inclusiveness.	3	Create space in meetings for all members to share input and encourage open communication	4	1	Team meetings will include time for input and respectful discussion.
 Project Health and Safety	Project health and safety is the practice of creating safe working conditions for personnel involved in the project. It involves implementing measures such as hazard assessment, risk management, training, enforcement, and investigation. Its main goal is to ensure that workers are not exposed to any unnecessary risks while performing their work.	Lifespan	Yes	The project is remote and digital. While physical risks are low, prolonged screen time and poor home setups can affect health.	Over time, this could lead to fatigue, posture-related injuries, or burnout.	2	Encourage healthy work habits, flexible hours.	3	1	Risks are real but mild. Team has some control over their home environment
		Servicing	No							
		Effectiveness	Yes	Stress from unclear deadlines or working in isolation may reduce people's ability to focus and perform well.	Low mental well-being can lead to more errors, reduced motivation, and lower-quality deliverables	2	Create a clear schedule, set reasonable deadlines, and encourage team communication	3	1	Mental safety is key.
		Efficiency	No							

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
		Fairness	Yes	Some team members may not have access to comfortable or quiet workspaces, which affects health differently across the team.	This could lead to uneven productivity and long-term health problems for some, causing inequity in work experience.	2	Offer scheduling flexibility and share health and workspace tips.	3	1	Access to a healthy work setup should be encouraged.
 Training and Qualifications	Training and qualifications is the process of ensuring that project team members have the necessary skills to effectively complete their work. It involves providing instruction, assessing proficiency, monitoring performance, and offering guidance.	Lifespan	Yes	The project does not currently include any structured training program for team members.	Lack of training could limit long-term skill development and reduce the chance for future sustainable work.	2	Offer basic training or onboarding in tools, science content, and digital collaboration methods.	3	1	Training supports growth for future projects and builds a stronger talent pool.
		Servicing	No							
		Effectiveness	Yes	Some contributors may lack experience in virtual lab design or online instructional methods.	This may lead to lower quality outputs or inconsistent design features.	2	Carefully match roles to skillsets and provide clear guidance and examples during design.	4	2	Good onboarding can significantly improve design quality and reduce rework.
		Efficiency	Yes	Without upfront training, team members may take longer to complete tasks or may need to redo work.	Time and resources could be wasted if tasks are done incorrectly due to skill gaps	2	Provide examples, templates, and brief walkthroughs of tasks before assigning them	3	1	Even short training improves speed and consistency.
		Fairness	Yes	Not all team members have equal access to past training or digital work experience, especially if hired locally or part-time.	Unequal skills can create unfair workload distribution or leave some team members behind.	3	Make sure all team members receive the same instructions, expectations, and access to support.	4	1	Equal support helps create a fair and inclusive project environment.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
 Organizational Learning	Organizational learning is a form of knowledge management in which organizational components and individual employees are encouraged to capture, share, and apply their knowledge. This enables the organization to adapt and improve its processes, products, and services over time.	Lifespan	Yes	The project is short-term and doesn't yet have a process for collecting lessons learned or feedback.	Important knowledge may be lost after the project ends, which limits growth and improvement for future projects.	2	Document lessons learned, team feedback, and key decisions throughout the project.	4	2	Capturing what worked well and what did not will help the business improve over time.
		Servicing	No							
		Effectiveness	Yes	Team members work independently, and knowledge is not always shared across roles.	Without knowledge sharing, similar mistakes might repeat, and teamwork may suffer.	2	Create shared folders for documentation and encourage quick check-ins for collaboration.	3	1	Team members can learn from each other if knowledge is made visible and accessible.
		Efficiency	Yes	Lack of shared tools or templates means that people might spend extra time figuring things out.	Time and effort are wasted if everyone starts from scratch or redoes work others already figured out	2	Develop shared templates, guides, and tools to make future work easier and faster as the company grows.	4	2	Having these files improves both speed and consistency.
		Fairness	Yes	If only some team members have access to internal knowledge, others may fall behind.	Unequal access to knowledge reduces fairness and creates gaps in performance and learning.	3	Make sure all key documents and lessons are shared with the whole team equally.	4	1	Equal access supports more balanced participation and professional growth.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
 Equal Opportunity	Equal opportunity is the practice of providing individuals with access to jobs, opportunities, and responsibilities based on their qualifications regardless of gender, race, age, or other characteristics. It seeks to eliminate any type of discrimination in the workplace and to ensure that all team members are treated fairly and given an equal chance to participate in an appropriate way.	Lifespan	Yes	The project currently uses informal networks for hiring, which may unintentionally limit diversity in the team.	If certain groups are left out, the project misses out on varied perspectives and long-term inclusion suffers.	3	As the company grows, formalize hiring practices with open calls and transparent criteria	4	1	Inclusive processes help build a fairer company culture from the start.
		Servicing	No							
		Effectiveness	Yes	If diverse voices are not included in decision-making, the lab design may not reflect all student needs.	Less inclusive design can reduce the lab's usefulness and accessibility for a broader range of users.	3	Actively seek feedback from different team members and include inclusive design practices.	4	1	Inclusive inputs lead to better, more relevant educational products.
		Efficiency	No							
		Fairness	Yes	The team is small and informal, which can make fairness harder to track if there are no clear guidelines.	Without clear standards, unconscious bias could influence decisions or assignments.	3	Write simple hiring and task assignment guidelines that promote fairness and non-discrimination.	4	1	A short fairness policy can help set expectations early on.
	Local competence development is the process of fostering and expanding skills, knowledge, and	Lifespan	Yes	The project focuses on design and uses a small team, so local capacity-building is not yet a formal goal.	This limits the project's long-term contribution to local education or tech skill growth.	2	Intentionally involve local professionals, students, or	4	2	Early collaboration can lay the foundation for future development and partnerships.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
 Local Competence Development	expertise in the localities in which the project operates. It can involve providing training or education to local individuals, as well as encouraging collaboration and the sharing of resources between the project organization and local organizations or local individuals.						institutions in the design process			
		Servicing	No							
		Effectiveness	Yes	If local talent is not involved, the lab may not align with Belizean classroom or local teaching needs.	The lab may miss key context-specific issues or opportunities for impact.	3	Get feedback from local educators or science students to tailor the lab content and usability.	4	1	Local input can help ensure the lab is relevant and useful in Belize.
		Efficiency	No							
		Fairness	Yes	Without intentional inclusion, opportunities may be given mostly to international or digitally connected individuals.	This could unintentionally exclude capable local individuals and create inequality in access to opportunities.	3	Make efforts to reach out to Belizean professionals and give fair access to collaboration roles.	4	1	This supports equitable access to experience and capacity-building locally.
 Work Life Harmony and Mental Health	Work-life harmony and mental health refers to the ability of individuals to strike a balance between their professional goals and commitments within their personal lives. This involves taking regular breaks from work,	Lifespan	Yes	Team members are working remotely and may struggle with screen time or lack of routine.	Over time, this can lead to burnout or emotional stress, especially in isolated working conditions.	2	Promote flexible schedules and recommend regular breaks and digital wellness practices.	3	1	Include well-being tips in onboarding or team communications.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
	developing healthy work habits, and engaging in activities that bring a sense of joy and contentment.									
		Servicing	No							
		Effectiveness	Yes	If team members feel overwhelmed, unsupported, or mentally drained, the quality of work may drop.	Mental fatigue can reduce focus, motivation, and creativity, lowering project effectiveness.	2	Build a work plan with reasonable timelines and open check-ins to monitor team wellness.	3	1	Encouraging breaks and input from the team can prevent burnout.
		Efficiency	No							
		Fairness	Yes	Not all team members have the same home environments, responsibilities, or access to support.	Those with more caregiving roles or stressful environments may be at a disadvantage, affecting equity.	3	Be flexible with deadlines and allow team members to set their preferred working times.	4	1	Supports an inclusive work environment that respects personal differences.
Subcategory	Society and Customers	Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
Element	Description									
	Community engagement is the practice of treating local residents as stakeholders in the project. This is essential as it ensures that local needs and perspectives are taken into consideration when taking any action that affects the community. It also requires a two-way exchange of information and ideas	Lifespan	Yes	The project includes plans to involve teachers, students, and education experts during the design process.	Early engagement builds lasting community connection and helps ensure long-term relevance of the lab.	4	Maintain communication with participants after design to keep them engaged in potential future phases.	5	1	Early input increases long-term ownership and usefulness in the local context.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
	between the project team and the community to make the project more effective, efficient, and beneficial for all involved.		Yes							
		Servicing		Feedback from local users is planned, but long-term support or responsiveness after launch has not been defined yet.	Community might feel disconnected if they cannot report issues or help shape future updates.	3	Design a simple follow-up mechanism (email form, support contact, or future check-ins).	4	1	Even a basic support system shows respect and openness to local voices.
		Effectiveness	Yes	Input from real users will help tailor the lab to Belizean students and classroom needs.	Leads to a more usable, relevant, and impactful learning tool.	4	Actively incorporate feedback into design decisions and validate changes with participants	5	1	Improves the quality and cultural relevance of the final product.
		Efficiency	Yes	Including feedback may require extra time during design but helps avoid mistakes or rework later.	Prevents wasted effort and improves design success on the first try.	4	Use quick interviews and guided feedback sessions to keep the process focused and efficient.	5	1	Early engagement saves time overall by reducing uncertainty later.
		Fairness	Yes	The project aims to include voices from different roles (teachers, students, experts), supporting fairness and representation.	Ensures that design decisions are informed by those directly impacted — not just internal assumptions.	4	Track who is consulted and seek diverse input (rural/urban, public/private school voices).	5	1	Inclusive engagement strengthens legitimacy and fairness of the project.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
 Public Policy and Compliance	Public policy and compliance includes the steps taken by the project team to ensure that the project complies with all relevant laws and regulations. This involves researching relevant laws and regulations, understanding their implications for the project, and taking necessary steps to make sure these laws and regulations are respected throughout the project's duration.	Lifespan	Yes	The lab is in early design and has not yet been reviewed against Belize's education policy or digital content guidelines.	Long-term use could be blocked or delayed if it does not meet educational or legal standards.	3	Research local education and digital content rules and design the lab to align with them.	4	1	Early alignment reduces the risk of rejection by schools or government.
		Servicing	Yes	There is no current plan for monitoring changes in relevant policies after the lab is created.	Over time, the lab could become non-compliant if laws or academic standards change	2	Build a policy-check step into future updates or reviews of the lab.	3	1	Ongoing review ensures the lab stays usable and relevant.
		Effectiveness	Yes	If laws around student privacy, content use, or accessibility are ignored, the lab may lose credibility or cause harm.	Compliance supports ethical, safe, and trusted learning environments.	3	Follow digital safety, accessibility, and academic integrity standards from the start.	4	1	Trust in the lab depends on meeting known rules and expectations.
		Efficiency	Yes	Not following regulations could cause delays or expensive rework if the lab is rejected or flagged later.	Early compliance helps avoid time loss or needing to redo large parts of the project.	3	Identify major compliance needs early and include them in project templates or reviews.	4	1	Being proactive avoids costly surprises.
		Fairness	Yes	If policies like accessibility or inclusion are not followed, some groups may be excluded (e.g.,	Non-compliance may lead to unequal access and social exclusion.	3	Design with accessibility and inclusiveness in mind, even if not	4	1	Fair design respects the rights and needs of all learners.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
				students with disabilities).			strictly required yet.			
 Protection for Indigenous and Tribal Peoples	Protection for indigenous and tribal peoples includes the measures taken to ensure the rights and wellbeing of affected populations over the course of the project. This includes protection of their culture, land use rights, language, religion, and other forms of recognition.	Lifespan	Yes	The lab has not yet considered how its content may (or may not) reflect Indigenous perspectives, contexts, or accessibility needs.	If not addressed early, the lab may unintentionally exclude Indigenous learners or ignore cultural relevance.	2	Explore ways to include examples, scenarios, or visuals that reflect Belize’s cultural and geographic diversity.	3	1	Early inclusion helps the lab feel relevant and respectful to more users.
		Servicing	No							
		Effectiveness	Yes	If the lab does not consider cultural relevance, some learners may not fully connect with the content.	Culturally disconnected content may reduce engagement, comprehension, or trust.	3	Review materials for cultural bias and consider including Belizean examples familiar to Indigenous communities.	4	1	Improves inclusiveness and learning outcomes for all users.
		Efficiency	No							
		Fairness	Yes	Without active consideration, the lab could unintentionally leave out Indigenous learners or fail to represent their identities.	This would limit access and create inequality in educational tools meant to serve national users.	3	Make fairness part of your design checklist by including diverse voices, languages, or themes where appropriate.	4	1	Promotes equity and allows culture to be included in national-level education content.
	Customer health and safety includes the measures taken to ensure the physical and mental wellbeing of the end users of	Lifespan	Yes	The lab is designed for long-term use but does not yet include features that support pacing or reduce screen fatigue.	Over time, this could negatively affect student wellbeing or reduce sustained engagement.	3	Add options to pause, encourage breaks, and provide time estimates for lab activities.	4	1	Mental wellness features support healthier long-term usage.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
 Customer Health and Safety	the project’s results. This includes providing information about risks and hazards, proper customer handling during the project, and adherence to relevant safety standards, protocols, laws, and regulations.									
		Servicing	No							
		Effectiveness	Yes	If instructions or feedback are unclear, students may misuse the lab or become frustrated.	Poor usability could reduce learning outcomes or cause unnecessary stress.	3	Design with student-friendly instructions and clear navigation to reduce confusion	4	1	Good design supports emotional comfort and confidence while learning.
		Efficiency	No							
		Fairness	Yes	Students with visual, learning, or internet access challenges may not be able to use the lab equally.	Unequal access can exclude or disadvantage certain groups, affecting social sustainability.	3	Apply accessibility standards (e.g., large fonts, low bandwidth modes, alt text) during design.	4	1	Improves access and safety for all types of learners
 Product and Service Labeling	Product and service labeling includes procedures used to ensure that goods and services are accurately labeled according to legal and ethical standards. This includes properly disclosing potential risks, hazards, and side effects associated with the use of	Lifespan	Yes	The lab has not yet included labels or descriptions that clearly explain its purpose, age group, or learning goals.	Users may misunderstand what the lab is for, which could reduce trust and usefulness over time.	3	Add a simple overview, learning objectives, and user type (e.g., “for secondary science students”).	4	1	Helps students and teachers know exactly what to expect and how to use the lab.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
	products and services as well as providing appropriate information about the origins of these products and services.									
		Servicing	No							
		Effectiveness	Yes	If instructions, warnings (e.g., “This is a simulation”), or usage guidance are missing, users may misuse or misunderstand the lab.	Could lead to confusion or ineffective learning experiences.	3	Include clear labels, usage tips, and a short FAQ to help users get started.	4	1	Improves clarity, learning outcomes, and user confidence.
		Efficiency	No							
		Fairness	Yes	If it is unclear who the lab is meant for, some students or teachers may feel excluded or try to use it without proper support.	Increases the risk of unequal access or confusion for underrepresented or new users.	3	Make inclusive labeling a design standard: including language level, target grade, and content themes.	4	1	Clear communication makes the lab more accessible and equitable for all users
 Customer Privacy and Data Protection	Customer privacy and data protection encompasses the measures taken to safeguard customer data such as personal information or financial details. It includes providing secure storage facilities and encryption technologies, implementing appropriate access controls and authentication	Lifespan	Yes	The project does not currently handle user data, but this may change in later versions as the lab becomes interactive.	If data privacy is not built into the design now, the lab may face legal or ethical issues later.	3	Begin outlining a basic data policy, even if no data is collected yet.	4	1	Clarity builds trust and eases future development with privacy in mind.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
	procedures, and ensuring compliance with relevant laws and regulations.									
		Servicing	No							
		Effectiveness	Yes	If users (especially schools or parents) are concerned about privacy, they may avoid using the lab.	Trust and safety are essential to use and adoption, especially in schools.	3	Include a privacy statement and make sure no student data is collected or shared unintentionally.	4	1	Transparency about data use supports safe adoption and user comfort.
		Efficiency	No							
		Fairness	Yes	If privacy protections are not included, students from lower-resourced schools or vulnerable groups may be more exposed.	Unequal protection of privacy could lead to digital harm or unequal treatment.	3	Follow universal privacy guidelines to ensure equal protection across all user groups.	4	1	Protecting all users equally supports social equity and reduces risk.
Subcategory	Human Rights	Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
Element	Description									
 Harassment and Discrimination	Harassment and discrimination involves the measures adopted to ensure a safe, respectful, and non-discriminatory workplace environment. This includes developing policies that protect employees from unjust treatment, creating an inclusive environment, implementing effective reporting procedures for	Lifespan	Yes	The project does not have a formal code of conduct or anti-harassment policy in place due to its small size and short timeline.	This may set the stage for unclear expectations or future issues in larger or ongoing work.	3	Add a brief team agreement or code of conduct with clear expectations around respectful behavior.	4	1	Early values-setting can prevent problems and guide future team culture.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
	instances of inappropriate behavior, and providing sufficient training for management on how to handle such issues.									
		Servicing	No							
		Effectiveness	Yes	Without clear expectations, disrespect or bias could harm collaboration and team motivation.	Harassment or exclusion reduces communication and productivity, even in remote projects.	3	Discuss respectful collaboration upfront and define how concerns should be raised.	4	1	Proactive communication improves collaboration and trust.
		Efficiency	No							
		Fairness	Yes	Without guidance, decisions or feedback may be influenced by unconscious bias, especially in hiring or task assignment.	This could lead to unequal treatment and lower morale.	3	Use inclusive practices and check for fairness when assigning tasks or hiring.	4	1	Reinforces your commitment to fairness and human dignity in all collaborations.
	Age-appropriate labor means ensuring that children are not put in dangerous or exploitative situations while still allowing them to develop essential job skills. It is used to describe work suitable for a person's skill level and maturity.	Lifespan	No							
		Servicing	No							
		Effectiveness	Yes	If students (e.g., minors) are included in testing, and tasks are not age-appropriate or clearly explained, they may	This can negatively affect their learning experience and lead to discomfort or disengagement.	2	Limit tasks to simple feedback (e.g., user reactions) and ensure parental or	3	1	Keep student involvement safe, light, and guided — this is an educational, not work-based, interaction

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
				be confused or overwhelmed.			teacher oversight if needed.			
		Efficiency	No							
		Fairness	Yes	If minors participate without proper consent or clear communication, their role may be misunderstood or feel exploitative.	Could create ethical concerns about unpaid or inappropriate participation in a project.	2	Set age-appropriate boundaries: no task assignments, just voluntary feedback with adult supervision.	3	1	Avoid giving tasks or responsibilities to minors — treat them as learners, not workers.
 Forced and Involuntary Labor	Forced and involuntary labor means any work or service that is extracted from a person under the menace of punitive action against themselves or their families. It includes work where the payment is below subsistence levels, or where the payment is in goods which are not desirable. Forced and involuntary labor can take many forms including human trafficking, debt bondage, enslavement, and unjustly long working hours.	Lifespan	No							
		Servicing	No							

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
		Effectiveness	Yes	Team members are working on a freelance/contract basis. If the hours or payment are unclear, they may feel pressured to over-deliver.	This could reduce morale or cause burnout, lowering the quality of contributions	2	Set clear expectations for hours, deliverables, and compensation up front.	4	2	Transparency helps protect both team wellbeing and performance
		Efficiency	Yes	If someone is working too much for too little, it may result in turnover, hidden resentment, or delays.	This can lead to miscommunication, rushed work, or rework, which harms the overall efficiency of the project.	2	Define limits on hours and make sure all contributors are fairly compensated.	3	1	Fair pay and boundaries reduce hidden inefficiencies in remote teams.
		Fairness	Yes	Contributors are not being exploited, but there is no formal system to ensure this is always the case.	The lack of a contract or agreed terms could lead to misunderstandings about compensation or workload.	2	Use basic contracts or email confirmations for all work agreements.	4	2	Fairness comes from proactive, written agreements, even in small teams.
 Dignity, Diversity, Equity, and Inclusion	Dignity, diversity, equity, and inclusion (DDEI) is a set of values, principles, and practices that create an environment where everyone involved in the project feels respected, safe, and valued. It also involves providing opportunities for everyone to take part in relevant decision-making processes without facing discrimination or being subject to unfair treatment.	Lifespan	Yes	As a startup project, there are no formal DEI guidelines or training — just informal efforts to be respectful and inclusive.	Without intentional action, current practices may carry over to future work, good or bad.	3	Set basic team norms that support inclusion.	4	1	Promotes long-term positive culture and growth potential.
		Servicing	No							

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
		Servicing	No							
		Effectiveness	Yes	Without clear contracts or ethical sourcing, trust and quality may suffer, especially in cross-cultural or remote contexts.	Ethical procurement contributes to stronger, more motivated and aligned team members.	3	Use basic contracts or written agreements with ethical clauses.	4	1	Clear agreements strengthen collaboration and shared values.
		Efficiency	Yes	Verbal or unclear agreements can lead to misunderstandings, delays, or duplicated efforts.	Reduces workflow efficiency and may lead to rework.	2	Define scope, timelines, and payment terms clearly in writing	4	2	Avoids last-minute miscommunication or disputes.
		Fairness	Yes	Some team members may not have the same access to fair terms, especially if roles are recruited informally.	Without transparency, biases could occur even unintentionally.	2	Apply the same agreement process and criteria for all team members, regardless of background.	4	2	Equal treatment strengthens inclusion and trust.
 Anti-Corruption	Anti-corruption is the practice of rejecting both offers of and requests for gifts, payments, or other forms of benefits in order to influence the activities, results, or outcomes of the project. It involves making sure that the project is free of unethical practices such as bribery, money laundering, fraud, and embezzlement.	Lifespan	Yes	There are no formal anti-corruption statements or commitments built into the project yet.	This could weaken trust or future funding if stakeholders expect proof of integrity	2	Add a short transparency statement.	4	2	Sets a clear ethical tone and improves credibility early.
		Servicing	No							

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
		Effectiveness	Yes	Any appearance of bias or favoritism can reduce trust in your research or design.	Perceived or actual ethical issues can damage reputation and prevent development and implementation.	3	Ensure decision-making (e.g. interviews) is documented and based on fair criteria.	4	1	Transparency supports legitimacy and stakeholder confidence.
		Efficiency	No							
		Fairness	Yes	If access to collaboration or funding is based on personal connections rather than qualifications, others are unfairly excluded.	This undermines fairness and the project’s overall social sustainability.	3	Use open calls, documented evaluations, and avoid informal favoritism in team decisions.	4	1	Fair selection processes show integrity and help avoid conflict.
	Fair competition is the practice of ensuring that all parties wanting to provide products or services to the project have an equal opportunity to compete and win. It requires taking measures to ensure that no individual party has an unfair advantage due to size, wealth, influence, or any other factor. This includes enforcing laws and regulations against anticompetitive behavior such as price-fixing and market manipulation. Additionally, fair competition calls for creating transparent processes for bidding	Lifespan	Yes	Service providers have been selected informally. No defined competitive process for opportunities.	Over time, this could discourage others from participating or trusting future projects.	2	Create a simple, transparent process for inviting proposals or reviewing service options.	3	1	Fair and open practices support long-term credibility.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
	and contract awards to ensure fair opportunities for businesses of all sizes and types.									
		Servicing	No							
		Effectiveness	Yes	Choosing collaborators based on familiarity or convenience may result in mismatched skills or poor performance.	The wrong fit can affect quality, innovation, or teamwork.	2	Define selection criteria (e.g., experience, alignment with project goals) in writing.	3	1	Objective criteria improve quality and transparency.
		Efficiency	No							
		Fairness	Yes	Not all potential service providers may have access to the same opportunities if you rely only on existing networks.	This creates inequality and reduces diversity in your project's voices or services	2	Share calls for collaboration openly when possible and include new voices.	3	1	Builds equity in project development and stakeholder trust
 Responsible Technology	Responsible technology is the practice of taking into account ethical, legal, and social implications when running projects that involve new or emerging technologies. This includes developing and adhering to frameworks and policies related to data privacy, intellectual property rights, environmental impact, diversity, and inclusion. Responsible	Lifespan	Yes	The current design does not yet have a clear framework for digital ethics, accessibility, or intellectual property use.	Lack of planning could lead to long-term exclusion or tech misuse.	2	Develop simple design guidelines for accessibility, content rights, and responsible use.	4	2	Early design choices shape long-term behavior and inclusion.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
	technology also requires ensuring that technology is used in a safe and responsible manner.									
		Servicing	No							
		Effectiveness	Yes	If the lab is not inclusive or safe, institutions may not want use it or use it incorrectly.	Misuse or low adoption reduces educational impact.	3	Prioritize user testing and accessibility in design. Have simple and inclusive interfaces.	4	1	Thoughtful design boosts trust, usability, and effectiveness.
		Efficiency	No							
		Fairness	Yes	If tech is designed for fast connections, some students may be unintentionally excluded.	This limits equity and deepens the digital divide.	2	Apply inclusive design with low-data features	4	2	Fair design ensures broader access and real impact.
 Green Claims and Greenwashing	Green claims are statements made by an organization to indicate that a product or service has been designed and produced in a manner that is considered environmentally responsible. These claims typically relate to the organization’s efforts to reduce its environmental impact such as using recycled materials, renewable energy sources, and efficient production processes.	Lifespan	Yes	The lab may include informal claims like “saves energy” or “low-carbon alternative” without clear justification.	If these statements are seen as misleading, it can damage long-term trust in the project and your company’s values.	2	Only make environmental claims that are factual and measurable, or clearly described as estimates.	4	2	Honest communication supports a good reputation and long-term integrity.

People Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Initial Impact Score	Proposed Response	New Impact Score	Change	Comments (optional)
	Greenwashing is the practice of making false or misleading claims in order to mislead consumers into believing that a product or service is more environmentally friendly than it actually is. This can be done through deceptive language, exaggerations, or omitting relevant information about an organization’s true environmental practices.									
		Servicing	No							
		Effectiveness	Yes	If green benefits are overstated, stakeholders (e.g., educators, donors) may lose confidence in your approach.	Perceived dishonesty or exaggeration can reduce project legitimacy.	3	Clearly define what sustainability benefits are realistic (e.g., reduced need for travel).	4	1	Evidence-based information builds trust and credibility.
		Efficiency	No							
		Fairness	Yes	If environmental benefits are promoted without proof, it may give the project an unfair advantage over others.	This misleads funders, partners, or schools.	2	Use neutral, honest language when describing environmental aspects avoid exaggeration.	4	2	Ethical fairness requires clear, transparent communication.

Note. Own work.

Table 30. Planet Impacts

Planet Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
Subcategory	Transport									
Element	Description									
	Local procurement is the practice of purchasing products and services from local suppliers.	Lifespan	Yes	Some services are not locally procured; tech help and design may come from abroad.	This limits support to the local green economy.	2	Prioritize sourcing Belizean experts where possible for development or content creation.	3	1	Supports sustainable local economy.
		Servicing	No							
		Effectiveness	No							
		Efficiency	No							
		Fairness	Yes	Without intention, local providers may be left out due to lack of visibility or connections.	This reduces environmental and social sustainability in the local economy.	2	Publicize collaboration opportunities in Belizean academic or tech circles.	3	1	Encourages fair access for local sustainable providers
	Digital communication is the use of digital tools and platforms to communicate about the project. These tools can include websites, email newsletters, social media accounts, messaging applications, and other digital communication channels.	Lifespan	Yes	The project will rely on ongoing digital communication with team members, experts, and possibly users.	Long-term use of cloud-based tools can contribute to indirect energy demand.	3	Choose cloud tools hosted on green-certified servers where possible.	4	1	Improves long-term digital sustainability and reduces footprint.
		Servicing	No							

Planet Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
		Effectiveness	Yes	Over-reliance on high-data platforms may reduce accessibility in low-bandwidth or rural areas.	May exclude stakeholders or students with poor internet access, reducing the project's reach.	2	Use lightweight platforms and design for low-bandwidth compatibility.	4	2	Improves inclusivity and reduces unnecessary digital load.
		Efficiency	Yes	If the project uses too many apps or sends large files often, it can waste internet energy and storage.	Wasting digital resources uses more electricity than necessary and increases your carbon impact.	3	Use fewer tools, smaller file sizes, and shared folders to reduce data waste.	4	1	Simplifying digital communication saves energy and is more sustainable.
		Fairness	Yes	Without careful planning, some users may not be able to participate fully in digital communications	Increases the digital divide and limits fair access to engagement and learning.	3	Ensure communication tools are mobile-friendly and data-light when possible.	4	1	Equal digital access supports sustainability and inclusion.
	Traveling and commuting is the movement of project-related personnel between different locations. Traveling and commuting may include getting to the project site, attending off-site meetings, conducting off-site presentations, collecting data, and providing off-site support.	Lifespan	Yes	Travel is only occasional, for interviews or presentations.	Repeated small trips still generate emissions over time, especially by car.	3	Bundle meetings in fewer trips; use public transport or carpool when possible.	4	1	Helps reduce travel impact.
		Servicing	No							
		Effectiveness	No							

Planet Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
		Efficiency	Yes	Uncoordinated travel could waste fuel, time, and money.	More trips than necessary increase resource use and slow down progress.	3	Combine travel needs when possible and confirm meetings ahead of time.	4	1	Smart planning saves time, money, and fuel.
		Fairness	No							
 Logistics	Logistics is the planning and execution of activities related to transporting goods, raw materials, and services for use by the project. Logistics includes activities such as scheduling transportation, estimating costs, coordinating personnel, and making sure that all necessary procedures are completed on time.	Lifespan	No							
		Servicing	No							
		Effectiveness	Yes	If communication or resource-sharing is poorly planned, it could delay work or lead to duplication.	Disorganized logistics (even digital) can slow things down and cause frustration.	3	Use clear timelines, shared folders, and agreed tools to manage information flow.	4	1	Helps keep the digital “logistics” efficient and smooth.
		Efficiency	Yes	Wasting time through uncoordinated tasks or file sharing increases effort and energy use.	Efficient coordination reduces rework and makes better use of everyone’s time.	3	Create a simple shared schedule or checklist to avoid miscommunication.	4	1	Better planning = fewer delays and fewer unnecessary steps.
		Fairness	No							

Planet Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
Subcategory	Energy	Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
Element	Description									
 Energy Consumption	Energy consumption is the amount of energy used by the project throughout its duration. It encompasses all aspects of energy use from office lighting to the energy required for transportation.	Lifespan	Yes	The lab is meant to be used multiple times and at the student's own pace, increasing energy usage over time.	Over time, increased use can raise energy demand, especially if the lab is hosted on energy-heavy platforms.	3	Choose platforms that use energy-efficient or green-certified servers to reduce the impact of long usage.	4	1	Supports sustainability without limiting learning time or repeat use.
		Servicing	No							
		Effectiveness	No							
		Efficiency	Yes	If the platform or tools are not optimized, they may use more power than needed during student lab use.	Wasted energy from servers, or hosting can increase the project's carbon impact.	3	Select or design lab software that runs smoothly without needing high processing power.	4	1	Focus on tool efficiency, not limiting student use time or experience.
 GHG Emissions		Fairness	No							
	GHG emissions are gases (mostly carbon dioxide and methane) released into the atmosphere as a direct result of activities associated with the project. This includes emissions as a direct result of project energy consumption as well as emissions from transport of	Lifespan	Yes	The platform will be used long-term by students and teachers, which means ongoing digital energy use.	The longer it is used, the more emissions accumulate — especially if hosting is not renewable.	3	Choose a hosting service that uses renewable energy.	4	1	Reduces long-term emissions while supporting continued student access.

Planet Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
	procured goods, raw materials, and services. It also includes GHG emissions caused by the distribution, operation, and disposal of the project product.									
		Servicing	No							
		Effectiveness	Yes	Using platforms that use a lot of energy or poorly optimized increases electricity use and emissions.	Smarter technology choices reduce indirect emissions without affecting performance.	3	Choose lightweight platforms and avoid unnecessary software that increases energy demand.	4	1	Focuses on selecting efficient, low-emission digital infrastructure.
		Efficiency	No							
		Fairness	No							
	Renewable energy, also called alternative energy, is energy generated from sources that are replenished at a faster rate than they are consumed. These sources include solar, wind, water, and geothermal power. Clean energy return (CER) refers to the amount of renewable energy generated by the project or the project's product that is in excess of	Lifespan	No							

Planet Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
	the amount needed. CER is normally returned to the grid for use by others.		No							
		Servicing								
		Effectiveness								
		Efficiency								
		Fairness	No							
Subcategory	Land, Air, and Water	Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
Element	Description									
 Biological Diversity	Biological diversity, also known as biodiversity, refers to the variety of life forms on Earth. It includes all ecosystems and all species of plants, animals, bacteria, fungi, and microorganisms that make up a particular environment or habitat. It also includes all genetic variations of those species.	Lifespan	No							
		Servicing	No							
		Effectiveness	No							
		Efficiency	No							
		Fairness	No							

Planet Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
	Air and water quality involves measures of contamination in air and water sources.	Lifespan	No							
		Servicing	No							
		Effectiveness	No							
		Efficiency	No							
		Fairness	No							
	Water consumption is the usage of water during project activities. Although construction, manufacturing, and agricultural projects are probably the major users of water, all projects use water to some extent.	Lifespan	No							
		Servicing	No							
		Effectiveness	No							
		Efficiency	No							
		Fairness	No							
	Water displacement is the practice of diverting water sources that have been disrupted by the project away from areas that are prone to flooding and contamination.	Lifespan	No							

Planet Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
	Methods include dam construction, rerouting flowing water, building artificial wetlands, landscaping with rain gardens, and installing flood barriers. Water displacement is mostly an issue with construction, manufacturing, and agricultural projects.		No							
		Servicing								
		Effectiveness								
		Efficiency								
		Fairness								
Soil Erosion and Regeneration	Soil erosion is the loss of topsoil due to human activities such as construction, road building, or agricultural practices. It can be exacerbated by changes in the natural land cover and can have significant negative effects on local ecosystems. As with water displacement, soil erosion is mostly an issue with construction, manufacturing, and agricultural projects.	Lifespan	No							

Planet Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
	Regenerative design is a practice that draws on an understanding of how ecosystems function so that the project will regenerate resources rather than depleting them.									
		Servicing	No							
		Effectiveness	No							
		Efficiency	No							
		Fairness	No							
	Noise pollution is the creation of excessive, unpleasant, or disruptive sounds that can diminish quality of life. Noise pollution can be caused by activities such as blasting, heavy vehicle traffic, traffic jams, and operation of machinery or equipment.	Lifespan	No							
		Servicing	No							
		Effectiveness	No							
		Efficiency	No							
		Fairness	No							
Subcategory	Consumption	Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)

Planet Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
Element	Description									
 Recycling and Reuse	Recycling involves transforming a waste item into a useful one. Items that can be recycled run the gamut from plastic water bottles to computers to electrical generators.	Lifespan	Yes	The project uses digital tools and reusable content but does not create physical waste.	Using digital content again and again can reduce the need for printed materials or supplies.	3	Use open-source or shareable learning tools to reduce waste and increase reuse.	4	1	This helps avoid one-time-use resources over the long term.
	Reuse involves using the same item again and again or finding a new purpose for it.									
		Servicing	No							
		Effectiveness	Yes	Reusing digital materials helps save time and makes learning tools easier to deliver	Makes the project more effective by using resources that already work well.	3	Adapt free lab activities or templates to fit Belizean education.	4	1	This improves learning while saving time and effort
		Efficiency	Yes	Making everything from scratch takes time and energy. Reusing content saves both.	Helps deliver content faster and avoids wasting energy or storage.	3	Share templates, edit existing files, and avoid duplication.	4	1	Simple actions that reduce waste and keep the project productive.
		Fairness	Yes	If reuse is not encouraged, some team members may have more work than others.	This could create unfair workloads or unequal access to resources.	3	Make sure everyone has access to shared materials and tools.	4	1	Encourages equal contribution and teamwork.

Planet Impacts

		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
	Disposal of assets is the process of getting rid of an item which has reached the end of its useful life. This includes everything from consumer electronics to public infrastructure such as roads and bridges. Generally, assets should not be disposed of until they are no longer fit for use.	Lifespan	Yes	The project does not deal with disposal right now, but old digital files or devices may pile up over time.	Long-term digital clutter or outdated tech can waste space and energy if not handled well.	3	Plan for regular digital cleanups and responsible device use.	4	1	Helps keep the project clean and avoids waste over time.
	Disposal of goods and materials is the practice of getting rid of items that are no longer needed or wanted for the project. This includes disposing of both hazardous and non-hazardous waste in accordance with relevant laws and regulations.									
		Servicing	No							
		Effectiveness	Yes	If old content or systems are not removed, they can confuse users or slow down the project.	Poor disposal can make tools messy and harder to use.	3	Organize regular content reviews to archive or delete old files.	4	1	Makes sure users only access what's current and useful.
		Efficiency	Yes	Storing outdated materials or files uses storage and slows systems.	Leads to wasted storage and energy use.	3	Use cloud storage that can automatically archive and avoid unnecessary uploads.	4	1	Simple changes help reduce waste and improve speed.

Planet Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
		Fairness	Yes	If some team members deal with all the cleanup or tech issues, the burden is not shared fairly.	Can create extra work for certain people.	3	Share responsibility for keeping files and tools organized.	4	1	Encourages equal workload and better teamwork.
	Contamination and pollution is the release of waste materials or hazardous substances into the environment. It will almost always have a negative impact on ecosystems and human health. Contamination and pollution most often occurs due to neglectful practices in manufacturing, construction, agriculture, and related industries that generate waste materials or hazardous chemicals, but it can also occur in other projects that do a poor job of disposal.	Lifespan	Yes	The project will not create waste or pollution now, but long-term digital use may increase electricity demand.	More servers use and device charging over time can indirectly contribute to emissions.	3	Choose tools that are energy-efficient or hosted on greener platforms.	4	1	Supports long-term digital sustainability without limiting access.
		Servicing	No							
		Effectiveness	No							
		Efficiency	Yes	Overloading servers leads to unnecessary energy use, which contributes to pollution.	Efficient systems use less power and lower the indirect pollution.	3	Use simple platforms and limit unnecessary uploads.	4	1	Less waste = smoother performance and better for the planet.

Planet Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
		Fairness	No							
	is the creation of any excess or unneeded materials or byproducts during the project. This includes everything from leftover supplies and materials to wasted energy.	Lifespan	Yes	Over time, the project might collect unused files, outdated tools, or waste energy during development.	This can increase the project's footprint if not cleaned up or managed.	3	Plan regular content cleanups and avoid adding tools that will not be used.	4	1	Keeps the platform light and clean over time.
		Servicing	No							
		Effectiveness	Yes	If too much content is created with no clear purpose, it can confuse users and reduce quality.	It is harder for users to find what matters, which affects the lab's usefulness.	3	Review materials regularly and remove outdated or unused features or documents.	4	1	Help keep things focused and effective.
		Efficiency	Yes	Some digital waste could be built up from unused files or duplicate tools.	Could slightly waste energy and time, but no serious sustainability effect.	3	Keep team focused on core tools and avoid overcomplicating the workflow.	3	0	Helpful tips, but not a significant impact.
		Fairness	Yes	If some team members spend extra time managing or sorting waste others created that is not fair	Uneven workloads and frustration can hurt collaboration.	3	Set shared expectations for content organization and digital housekeeping.	4	1	Builds team accountability and reduces burnout.

Note. Own work.

Table 31. Prosperity Impacts

Prosperity Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
Subcategory	Project Feasibility									
Element	Description									
 Business Case Analysis	Business case analysis is the process of developing a business case that provides justification for the initiation or continuation of the project. It involves analyzing the underpinning logic of funding the project. This requires identifying the expected benefits and dis-benefits, likely costs and revenues, staffing requirements, major risks, schedule alternatives, and stakeholder impacts associated with a proposed project.	Lifespan	Yes	The business case shows the lab’s long-term value in education, but it does not yet outline how to sustain or adapt the solution over time.	Without sustainability or update plan, long-term value may weaken.	2	Add a section that explains how the lab will be updated, scaled, or monitored over time.	3	1	Good foundation, but a plan for the future would make it stronger.
		Servicing	No							
		Effectiveness	Yes	The case clearly identifies how the lab can solve existing problems in science education across Belize.	Strong educational justification that aligns with access, cost, and learning goals.	4	Include sample metrics (e.g., students reached, cost saved) to support future evaluation.	4	0	Very effective.

[illegible]

Prosperity Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
			Yes	supported for students with fewer resources.	funding gaps in poorer schools.	4	Include a section on how these social benefits will be tracked and improved over time.	5	1	through funding strategy.
 Social Return on Investment	Social return on investment (SROI) is a framework for measuring and accounting for project results and outcomes by including social and environmental costs and benefits along with the traditional economic ones. It is based on the idea that projects create value in ways other than just financial returns. For example, a community development project may create value by improving the health and well-being of residents, reducing crime, and increasing social cohesion.	Lifespan		The IVSL project is designed to have a long-term positive effect on education and inclusion.	Benefits like access and well-being can last well beyond initial use.					Strong long-term potential once monitoring is added.
		Servicing		No						
		Effectiveness		Yes	The project clearly addresses a key social need — better, more accessible science education.	Directly improves equity and access, especially for remote learners.	4	Include community feedback or interviews to better document the social results.	5	1
		Efficiency	Yes	The lab helps avoid unnecessary material use, saves travel	These “non-financial” gains are	4	Quantify time saved, grading hours reduced, or	5	1	

Prosperity Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
			Yes	time, and lowers effort for teachers.	socially valuable and cost-effective.	3	classroom space eased to show clear value.	4	1	Equity planning is key to achieving social value.
		Fairness		The project supports underserved groups but does not yet address all barriers (like devices or connectivity).	If not handled, these gaps could reduce the fairness of access.		Include specific plans to support students with poor connectivity or no personal devices.			
 Modeling and Simulation	Modeling is the creation of a physical, mathematical, or logical representation of the project using representative characteristics of the project.	Lifespan	Yes	The lab design includes interactive elements and some simulation planning, but not a full working model.	Simulations can improve long-term usability and reduce rollout mistakes.	3	Build a visual or digital prototype to test user flow and lab interaction design.	4	1	Helps make better long-term decisions and avoids rework.
		Servicing	No							
		Effectiveness	Yes	The simulations (science activities) help show the learning experience and potential engagement.	Makes it easier to understand how effective the lab could be.	4	Add usability testing with students/teachers to validate the model.	5	1	Strong support for understanding real outcomes.
		Efficiency	Yes	Simulations were not used yet to compare different technical setups.	Without this, time and money could be wasted during implementation.	2	Run a small pilot to model how different schools might use it.	3	1	Useful to identify the most efficient rollout plan.
		Fairness	Yes	The current design does not test how students with different devices, speeds, or tech levels would experience it.	This could lead to unfair learning experiences later on.	2	Simulate the lab under different user scenarios (e.g., rural vs urban) to spot access issues.	3	1	Great for equity and designing for all.
Subcategory	Business Agility	Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
Element	Description									

Prosperity Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
 Flexibility Optionality	Flexibility is the ability to adjust to changing circumstances or situations. It requires the capacity to modify plans or approaches when faced with unexpected challenges. Optionality means having multiple solutions or choices available. It means the project is not constrained by a single approach. Optionality means that the project is capable of supporting different outcomes with different results without having to start over.	Lifespan	Yes	The project is designed to evolve, but it does not yet have clear plans to adapt over time or expand to new areas.	Without adaptability, long-term relevance may decline.	3	Include ideas for expanding subject areas or upgrading the lab in future versions.	4	1	This increases its long-term usefulness.
		Servicing	Yes	If plans change (e.g., internet issues), there are no current backup strategies or offline options.	This could disrupt servicing or delivery if not prepared for.	2	Develop contingency options like offline modules or phone-accessible tools.	4	2	Strengthens delivery and access in low-resource settings.
		Effectiveness	Yes	The project is somewhat flexible, but does not yet support multiple implementation models as yet.	If schools vary in readiness, a rigid plan could lower effectiveness.	3	Design flexible roll-out options.	4	1	Makes the solution more widely usable.

Prosperity Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
		Efficiency	Yes	Without backup plans or optional tools, you time or resources might be wasted if challenges arise.	Optional tools save time when the first plan does not work.	2	Identify at least one alternative platform or delivery method in your plan.	3	1	A backup reduces stress and improves use of time/resources.
		Fairness	Yes	If students cannot access the main version, and there is no backup, they miss out.	This creates unequal access — especially in rural or tech-limited areas.	2	Build flexible access options (e.g., downloadable content or low-bandwidth version).	4	2	Helps level the playing field for all users
 Resiliency	Resiliency is the ability of the project to recover from or adjust easily to adverse conditions such as extreme market fluctuations, political or economic instability, natural disasters, or health emergencies. Resiliency does not make problems go away: it means having the ability to cope with them despite the unexpected stress.	Lifespan	Yes	The project could have lasting impact, but there is no long-term plan for surviving major disruptions.	Without preparation, external shocks could reduce its impact over time.	2	Include a resilience plan with possible risks and how the lab would continue or recover.	3	1	Adds to long-term sustainability.
		Servicing	Yes	No service plan exists for unexpected challenges like technical failure or policy shifts.	Could lead to downtime or project abandonment during stress.	2	Build a basic risk register and response strategies (e.g., low-tech backups, alternate delivery).	3	1	Adds safety and confidence for schools using the platform.
		Effectiveness	Yes	A lack of resilience planning means even good ideas may fail under pressure.	Could result in lost learning opportunities or trust.	2	Include roles/responsibilities for adapting the project if things change unexpectedly.	3	1	Helps maintain learning even during crises.

Prosperity Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
		Efficiency	Yes	If issues arise and no response is ready, time and money could be wasted. Students and schools in vulnerable areas are often hit hardest when disruptions happen.	Resiliency boosts efficiency by reducing panic and downtime. Without resilience planning, these groups are most likely to be left behind.	2	Build simple SOPs (standard operating procedures) for common disruptions. Plan inclusive responses that protect learning for marginalized or rural groups.	3	1	Prevents rushed decisions and resource waste.
		Fairness	Yes							
Subcategory	Market and Economic Stimulation	Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
Element	Description									
 Local Economic Impact	Local economic impact includes the direct and indirect effects the project has on the economy of its local area. This can include job creation, increased spending in the local economy, or increased regional development.	Lifespan	Yes	The lab reduces long-term costs for students and schools, but this is not highlighted in the current design	Savings can support household finances and school budgets over time.	3	Add a short section on expected cost savings for travel, lab materials, or resources.	4	1	Shows long-term community benefit, even if informal.
		Servicing	No							
		Effectiveness	Yes	The economic value of avoiding costs adds to the project’s usefulness in real life.	Better adoption likely if users see clear cost savings.	3	Include examples of money saved by using IVSL over physical labs.	4	1	Makes the case stronger for school leaders and funders.
		Efficiency	Yes	Saves money and resources without adding new costs for students but this is not currently presented in the design.	Higher efficiency means more impact with fewer inputs.	3	Show cost-efficiency in comparison to traditional science teaching methods.	4	1	Supports funding decisions and prioritization.

Prosperity Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
		Fairness	Yes	Students in rural areas or low-income households save more, but the benefit is not currently framed that way.	Cost savings may be most meaningful to those with fewer resources.	3	Emphasize how this helps level the playing field for marginalized communities.	4	1	Strengthens your social and economic equity.
 Indirect Benefits	Indirect benefits are the positive impacts that go beyond the immediate outcomes of the project and may not always be immediately visible. These benefits can include improved quality of life, increased economic activity in the local area, and environmental improvements such as cleaner air or water.	Lifespan	Yes	The design encourages long-term improvements in educational access and equity.	Can result in better opportunities, especially for rural students, over many years.	4	Include notes on how learning gains may lead to better future outcomes (education, jobs).	5	1	Value adds strength to the design.
		Servicing	No							
		Effectiveness	Yes	The IVSL helps teachers and students work more smoothly.	Boosts well-being, reduces academic pressure, and can increase retention	4	Highlight these benefits in communications or reporting for broader buy-in.	4	0	
		Efficiency	Yes	Less time commuting, grading, and coordinating labs means energy and resources are saved.	Creates smoother processes for everyone involved.	3	Quantify time savings.	4	1	Adds to justification for adoption.
		Fairness	Yes	The design supports inclusion but could further explain how it helps	Can support social mobility and reduce education gaps.	3	Describe how this improves access to science for students who face tech or distance barriers.	4	1	Helps frame the IVSL as a justice-oriented tool.

Prosperity Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
			Yes	disadvantaged students thrive						
	ESG disclosures are information about an organization’s performance and practices related to environmental, social, and governance issues. Information from the project is used as input to the ESG disclosures of the sponsoring organization(s). Sustainability reporting provides information about an organization’s policies, practices, and performance related to sustainability. It covers a wide range of topics such as energy efficiency, carbon emissions, resource conservation, human rights, labor practices, and community engagement. Information from the project is used as input to the sustainability reporting of the	Lifespan		The design supports environmental and social goals, but it does not say how these impacts could be reported later.	Could be useful for long-term tracking, especially for schools or donors.	2	Add a note explaining how this project supports education, access, and sustainability goals.	3	1	Adds long-term value and may help future users measure impact.

Prosperity Impacts										
		Lens	Scored?	Description (Cause)	Potential Sustainability Impact	Impact Score Before	Proposed Response	Impact Score After	Change	Comments (optional)
	sponsoring organization(s).									
		Servicing	No							
		Effectiveness	Yes	There is no way built into the design to collect or share data about sustainability progress.	Makes it harder for others to use the project in official reports.	2	Suggest adding simple ways to track reach, access, or savings later on.	3	1	This would help future partners measure success.
		Efficiency	Yes	It is not clear how the project helps organizations show efficient use of time or money.	This could limit support from funders who care about sustainability.	2	Add short statements that explain time or cost savings the lab might create.	3	1	Helps link the design to real-world funding goals.
		Fairness	Yes	The design supports equity and access, but does not frame this as part of a bigger social responsibility.	Missed chance to show how the project improves fairness for vulnerable groups.	2	Point out how the lab supports fairness, inclusion, and equal access to science education.	4	2	Makes it easier to include in social impact reports.

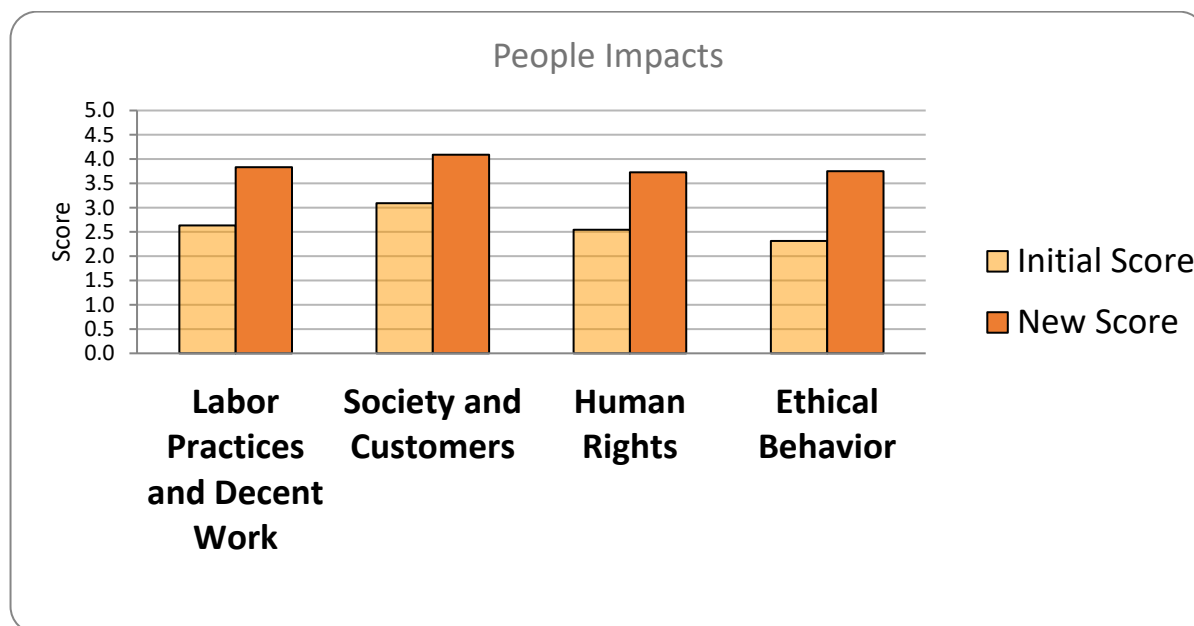
Note. Own work.

Table 32. Scoring Summary

People Impacts	Initial Impact Score	New Impact Score	Change
Labor Practices and Decent Work	2.6	3.8	1.2
Society and Customers	3.1	4.1	1.0
Human Rights	2.5	3.7	1.2
Ethical Behavior	2.3	3.8	1.4
Overall People Score	3.9		
Planet Impacts	Initial Impact Score	New Impact Score	Change
Transport	2.7	3.8	1.1
Energy	3.0	4.0	1.0
Land Air, and Water		4.0	
Consumption	3.0	3.9	0.9
Overall Planet Score	3.9		
Prosperity Impacts	Initial Impact Score	New Impact Score	Change
Project Feasibility	2.7	3.9	1.2
Business Agility	2.2	3.5	1.3
Local Economic Impact	2.8	3.8	1.0
Overall Prosperity Score	3.8		
Overall Project Score	3.8		

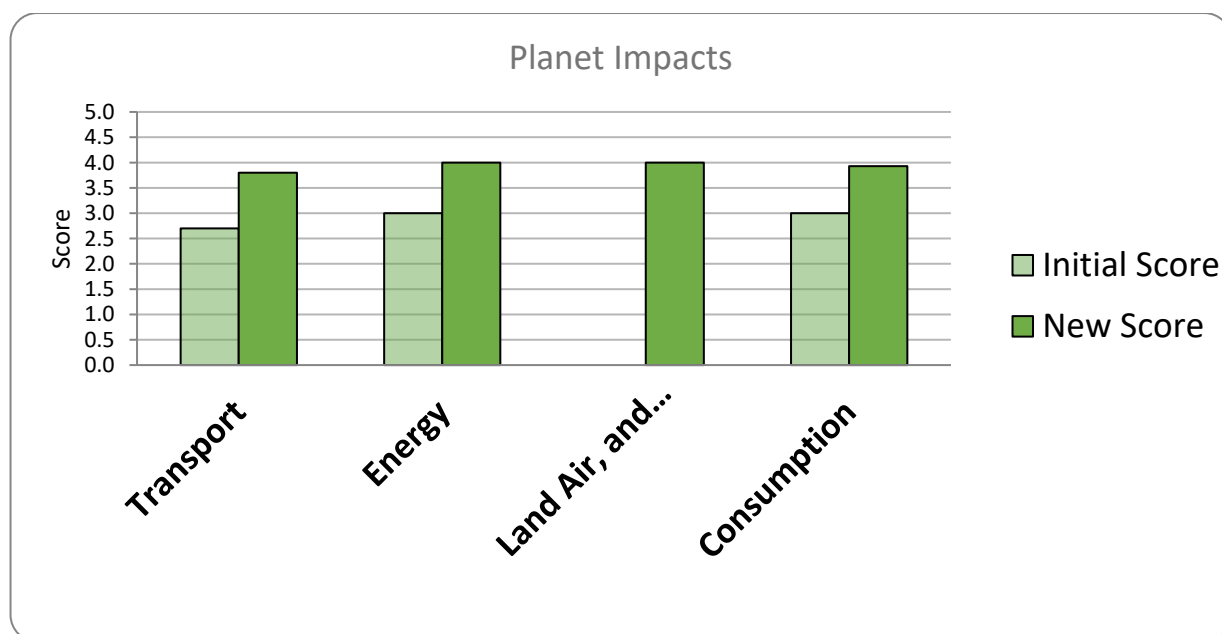
Note. Own work.

Figure 31. Bar graph showing initial and new impact scores for People Impacts.



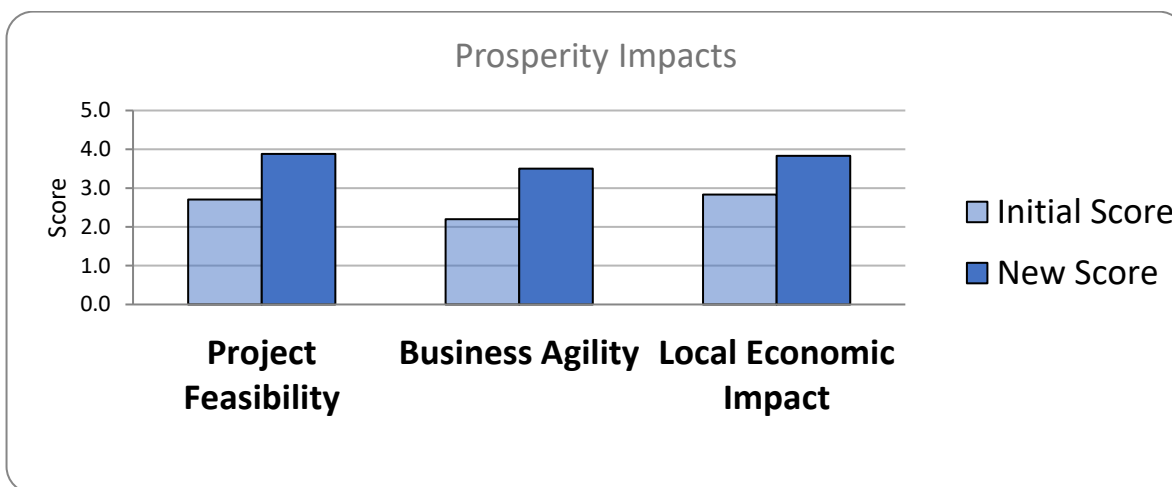
Note. Own work.

Figure 32. Bar graph showing initial and new impact scores for Planet Impacts.



Note. Own work.

Figure 33. Bar graph showing initial and new impact scores for Prosperity Impacts.



Note. Own work.

The scoring summary in **Table 32** and the bar graphs found in **Figures 31- 33** above from the P5 Impact Analysis clearly show that the proposed project improvements have significantly enhanced sustainability across the categories of people, planet, and prosperity. Specifically, the scores show notable improvements in ethical behavior, societal impact, human rights, labor practices, transportation, energy consumption, and environmental impacts. Additionally, improvements in project feasibility, business agility, and local economic impact show that the project can positively support economic growth. Overall, these results show that the planned sustainability actions effectively improved the Interactive Virtual Science Laboratory.

7.3 Relationship of the project to the dimensions of Regenerative Development

Regenerative Development as previously mentioned is an approach aimed at renewing and improving systems to sustain their health over the long term. It goes beyond minimizing harm by actively restoring and enhancing ecosystems, communities, and economies. There are six key dimensions involved: environmental, social, economic, political, cultural, and spiritual (Müller, 2021).

- **Environmental Dimension:** This dimension involves protecting and restoring nature. The Interactive Virtual Science Laboratory supports the environment by reducing waste, energy use, and pollution compared to traditional science labs. Virtual experiments use fewer resources, helping to protect biodiversity and reduce climate change. The project also supports global sustainability goals like quality education (SDG 4) and climate action (SDG 13) (United Nations, 2015).
- **Social Dimension:** The social dimension aims to create fair and inclusive communities. The virtual lab helps students in rural or underserved areas gain access to good science education, reducing educational gaps. Regular feedback from community groups helps the project stay fair and inclusive.
- **Economic Dimension:** Economically, the project benefits people with limited financial resources by lowering the cost of science education. It cuts down expenses related to physical labs and travel. This helps narrow economic gaps by giving equal opportunities to students regardless of their financial situation. While money remains the main method of exchange, the virtual lab also promotes exchange through skills and knowledge which are valuable resources.
- **Political Dimension:** Politically, the project encourages transparency and participation. Open communication methods involve local voices, women, and

youth in making decisions. Regular feedback gives citizens the power to actively shape their educational future. This ensures no community voices are excluded.

- **Cultural Dimension:** Culturally, the project respects local identities by including culturally relevant content. It values and incorporates traditional knowledge where applicable to activities or examples. Since it is digital, the lab minimizes disturbances to the local environment which shows respect for the community and therefore its customs and traditions.
- **Spiritual Dimension:** Spiritually, regenerative development promotes ethical values, human connection, and reflection. The virtual lab follows strong ethical standards and encourages responsible teaching. It supports respectful and judgment-free interactions among students, providing opportunities for active listening and cooperation. The design also creates space for reflection and critical thinking at each student's own pace.

Validating projects within regenerative development helps ensure long-term benefits that align with sustainability and fairness. Linking these regenerative dimensions with the earlier P5 Impact Analysis (P5IA) confirms the strong sustainability impact of the Interactive Virtual Science Laboratory, especially in environmental, social, and economic areas. This shows clear connection between the project and regenerative development principles.

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9 APPENDICES

APPENDIX 1: FGP Charter**CHARTER OF THE PROPOSED
FINAL GRADUATION PROJECT (FGP)**

1. Student name

Aisha Marie Leiva

2. FGP name

Project Management Plan for Designing an Interactive Virtual Science Laboratory

3. Application Area (Sector or activity)

Science Education, Digital Learning Technology
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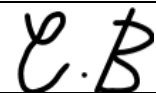
4. Student signature



5. Name of the Graduation Seminar facilitator

Carlos Brenes Mena

6. Signature of the facilitator



7. Date of charter approval

April 11, 2025

8. Project start and finish date

April 11, 2025	August 28, 2025
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9. Research question

What elements are required to develop a structured Project Management Plan for the effective design of an interactive virtual science laboratory that enhances student engagement, improves learning outcomes, and increases efficiency?

10. Research hypothesis

Developing a structured Project Management Plan that integrates key project management knowledge areas will facilitate the effective design of an interactive virtual science laboratory, ensuring enhanced student engagement, improved learning outcomes, and increased efficiency.

11. General objective

To develop a structured Project Management Plan, based on the standards of the Project Management Institute, to guide the effective design of an interactive virtual science laboratory.

12. Specific objectives

1. To create a Project Charter that formally authorizes the project and establishes its purpose and objectives.
2. To create a Scope Management Plan to define the project's scope, requirements, and deliverables.
3. To create a Schedule Management Plan to outline the project timeline and key milestones for the design of the interactive virtual science laboratory.
4. To create a Cost Management Plan to develop cost estimates and establish the budget for the design of the interactive virtual science laboratory.
5. To create a Quality Management Plan to define quality standards and ensure the design meets educational and technological requirements.
6. To create a Resource Management Plan to determine and allocate the resources needed for the design of the interactive virtual science laboratory.
7. To create a Communication Management Plan to establish how project information will be shared, ensuring clear and effective communication among stakeholders.
8. To create a Risk Management Plan to identify potential risks, assess their impact, and develop strategies to manage them.
9. To create a Procurement Management Plan to define the process for acquiring external resources and services required.
10. To create a Stakeholder Engagement Plan to identify key stakeholders and define how they will be engaged throughout the project.

13. FGP purpose or justification

Science education relies on laboratory experiments to help students understand complex concepts. However, traditional science labs are expensive to maintain, require large amounts of materials, and are not always accessible to students (Sellberg, Nazari, & Solberg, 2024). Many institutions face challenges such as limited lab space, scheduling conflicts, and high costs of chemicals and equipment (Bazie & Lemma, 2024). Additionally, many students struggle to fully understand lab procedures by just reading instructions from a manual. They may not grasp key concepts, leading to confusion and poor retention of knowledge (McGraw Hill, 2022). Commuting students often stay late for labs or make special trips just to attend, adding to their travel costs and time on campus. Fully online students, on the other hand, have little or no access to hands-on lab experiences (Beyond the Classroom Walls, 2023). Instructors also spend long hours grading traditional lab reports, adding to their workload and making the process time-consuming. The Interactive Virtual Science Laboratory (IVSL) was designed to address these issues by providing a flexible, engaging, and cost-effective alternative to traditional science labs.

The IVSL aimed to enhance student engagement, improve learning outcomes, and increase efficiency by allowing students to practice experiments in an interactive, low-stress environment. In traditional labs, students often experience stress and anxiety of getting an experiment right on the first try. Virtual labs remove this pressure by allowing students to repeat experiments as many times as needed, helping them learn from mistakes and build confidence (Shivam & Wagoner, 2020). Furthermore, many students complete lab reports by relying on textbook information instead of analyzing and applying what they learned. Virtual labs integrate real-time assessments and interactive simulations, ensuring that students actively engage with the material and apply their knowledge (Science Interactive, 2023).

From a cost perspective, research shows that virtual labs can reduce costs by 48% on average due to the elimination of expenses on consumable materials and maintenance (Design and Implementation of Virtual Laboratories for Higher Education Sustainability, 2022). Additionally, studies have demonstrated that students using virtual labs improved their test scores by 20-30% compared to those using only traditional lab methods (Bazie & Lemma, 2024). A case study at Nankai University also found that student engagement increased by 35% after virtual lab implementation, demonstrating a significant improvement in learning outcomes (Development and Implementation of Virtual Physics Laboratory, 2023). For instructors, virtual labs also reduce the time spent on manually grading reports. Pre-lab and post-lab assessments in virtual labs reduce grading workloads and save instructors' time. The questions are automatically graded, allowing for quicker feedback and improved efficiency. The IVSL makes science labs more accessible, reduces costs, improves learning, and saves instructors time, creating a better experience for both students and teachers.

14. Work Breakdown Structure (WBS).

Final Graduation Project- Project Management Plan for Designing an Interactive Virtual Science Laboratory

1. Graduation Seminar (FGP profile)

1.1 FGP Deliverables

1.1.1 Appendices

1.1.1.1 FGP Charter

1.1.1.2 Preliminary Bibliographic Research

1.1.1.3 FGP WBS

1.1.1.4 FGP Schedule

1.1.2 Chapter 2 - Theoretical Framework

1.1.3 Chapter 3 - Methodological Framework

1.1.4 Chapter 1 - Introduction

1.1.5 Chapter 7- Project validation in regenerative and sustainable development

1.1.6 Abstract

1.1.7 Executive Summary

1.1.8 References

1.1.9 Indexes

1.2 Graduation Seminar Approval

2. Tutoring Process

2.1 Tutor

2.1.1 Tutor Assignment

2.1.2 Communication

2.2 Adjustment of Previous Chapters

2.3 Chapter 4 - Results

2.3.1 Project Charter

2.3.2 Scope management Plan

2.3.3 Schedule Management Plan

2.3.4 Cost Management Plan

2.3.5 Quality Management Plan

2.3.6 Resource Management Plan

2.3.7 Communication Management Plan

2.3.8 Risk Management Plan

2.3.9 Procurement Management Plan

2.3.10 Stakeholder Management Plan

2.4 Chapter 5 - Conclusion

2.5 Chapter 6 – Recommendations

3. Reading by reviewers

3.1 Reviewers Assignment Request

3.1.1 Assignment of two reviewers

3.1.2 Communication

3.1.3 Submission to reviewers

- 3.2 Reviewers Work
 - 3.2.1 Reviewer 1
 - 3.2.1.1 FGP Reading
 - 3.2.1.2 Reader 1 Report
 - 3.2.2 Reviewer 2
 - 3.2.2.1 FGP Reading
 - 3.2.2.2 Reader 2 Report

4. Adjustments and Modification

- 4.1 Report for reviewers
- 4.2 FGP Update
- 4.3 Second review by reviewers

5. Presentation to the Board of Examiners

- 5.1 Final review by the board
- 5.2 FGP Grade Report

15. FGP budget

The budget estimated to develop and complete the FGP (Project Management Plan for Designing an Interactive Virtual Science Laboratory) is outlined below for a total of BZD \$550.00 (USD \$275.00).

Description	Unit price	Quantity	Total
Printing and Binding FGP	\$150	1	\$150
Mailing Fee (Belize to Costa Rica)	\$100	1	\$100
Document Review by Philologist	\$300	1	\$300
Total			\$550

16. FGP planning and development assumptions

The following assumptions are made in the development of the Project Management Plan for Designing an Interactive Virtual Science Laboratory.

1. It is assumed that key stakeholders will be willing to provide input and feedback to ensure alignment between the project's objectives and application.
2. It is assumed that essential software, such as Microsoft Office, MS Project, SimpleMindPro, and PDF tools, will be accessible for document preparation, formatting, and final submission.
3. It is assumed that the formatting, structure, and requirements for the FGP, as outlined in the university's regulations, will remain unchanged.
4. It is assumed that UCI's academic resources and faculty support will remain accessible, and that tutors will provide guidance as outlined in the university's FGP process.

5. It is assumed that the researcher will dedicate a minimum of 15 hours per week to developing the FGP within the allocated schedule for completion

17. FGP constraints

1. There is a lack of documented case studies and research on virtual science laboratories in Belize and the Caribbean, requiring reliance on international sources that may not fully reflect the local educational environment and challenges.
2. The FGP development is restricted to a fixed budget of BZD \$550 (USD \$275), which limits the ability to access paid research databases, professional consultations, or additional resources.
3. The project is confined to developing a Project Management Plan only, without extending to prototype creation, software development, or testing, which may limit the practicality of the final recommendations.
4. The FGP development is undertaken by one researcher (the student), requiring the completion of all deliverables independently, which may affect the depth of analysis and project scope management.
5. The FGP must be completed within the three-month period established by the university, limiting the depth of research, revisions, and refinements that can be incorporated.

18. FGP development risks

1. If reviewers take longer than expected to provide feedback or if the feedback is unclear, necessary revisions may be delayed, increasing the risk of rushed submissions and reduced quality.
2. Since educational institutions in the country rely on traditional in-person labs, there is a risk that key stakeholders may be hesitant to accept a fully virtual approach. This could result in limited engagement, skepticism, or reduced feedback and input on the management plan.
3. If unplanned professional or personal commitments arise, the researcher's ability to dedicate sufficient time and focus to completing the FGP at the expected quality level may be affected.
4. If feedback requires major changes, there is a risk that the additional workload may become overwhelming, making it harder to complete all revisions effectively within the given timeframe.
5. If stakeholders show strong interest and support for the proposed virtual science laboratory, the project could gain momentum beyond the FGP, creating opportunities for collaboration and potential implementation in schools.

19. FGP main milestones

Deliverable	Estimated Start Date	Estimated Finish Date
1. Graduation Seminar (FGP profile)	Feb 18, 2025	April 21, 2025
1.1 FGP Deliverables	Feb 18, 2025	April 7, 2025
1.1.1 Appendices	Feb 18, 2025	April 7, 2025
1.1.1.1 FGP Charter	Feb 18, 2025	April 7, 2025
1.1.1.2 Preliminary Bibliographic Research	Feb 18, 2025	Feb 24, 2025
1.1.1.3 FGP WBS	Feb 24, 2025	March 3, 2025
1.1.1.4 FGP Schedule	Feb 24, 2025	March 3, 2025
1.1.2 Chapter 2 - Theoretical Framework	March 3, 2025	March 17, 2025
1.1.3 Chapter 3 - Methodological Framework	March 17, 2025	March 24, 2024
1.1.4 Chapter 1 - Introduction	March 24, 2025	March 31, 2025
1.1.5 Chapter 7- Project validation in regenerative and sustainable development	March 24, 2025	March 31, 2025
1.1.6 Abstract	March 31, 2025	April 7, 2025
1.1.7 Executive Summary	March 31, 2025	April 7, 2025
1.1.8 References	March 31, 2025	April 7, 2025
1.1.9 Indexes	March 31, 2025	April 7, 2025
1.2 Graduation Seminar Approval	April 8, 2025	April 21, 2025
2. Tutoring Process	April 22, 2025	July 18, 2025
2.1 Tutor	April 22, 2025	April 29, 2025
2.1.1 Tutor Assignment	April 22, 2025	April 22, 2025
2.1.2 Communication	April 22, 2025	April 29, 2025
2.2 Adjustment of Previous Chapters	April 30, 2025	May 2, 2025
2.3 Chapter 4 - Results	May 3, 2025	July 11, 2025
2.3.1 Project Charter	May 3, 2025	May 9, 2025
2.3.2 Scope management Plan	May 10, 2025	May 16, 2025
2.3.3 Schedule Management Plan	May 17, 2025	May 23, 2025
2.3.4 Cost Management Plan	May 24, 2025	May 30, 2025
2.3.5 Quality Management Plan	May 31, 2025	June 6, 2025
2.3.6 Resource Management Plan	June 7, 2025	June 13, 2025
2.3.7 Communication Management Plan	June 14, 2025	June 20, 2025
2.3.8 Risk Management Plan	June 21, 2025	June 27, 2025
2.3.9 Procurement Management Plan	June 28, 2023	July 4, 2025
2.3.10 Stakeholder Management Plan	July 5, 2025	July 11, 2025
2.4 Chapter 5 - Conclusion	July 12, 2025	July 15, 2025
2.5 Chapter 6 - Recommendations	July 12, 2025	July 15, 2025
3. Reading by reviewers	July 25, 2025	August 6, 2025

3.1 Reviewers Assignment Request	July 25, 2025	July 26, 2025
3.1.1 Assignment of two reviewers	July 25, 2025	July 25, 2025
3.1.2 Communication	July 25, 2025	July 26, 2025
3.1.3 Submission to reviewers	July 25, 2025	July 26, 2025
3.2 Reviewers Work	July 27, 2025	August 6, 2025
3.2.1 Reviewer 1	July 27, 2025	August 6, 2025
3.2.1.1 FGP Reading	July 27, 2025	August 6, 2025
3.2.1.2 Reader 1 Report	August 6, 2025	August 6, 2025
3.2.2 Reviewer 2	July 27, 2025	August 6, 2025
3.2.2.1 FGP Reading	July 27, 2025	August 6, 2025
3.2.2.2 Reader 2 Report	August 6, 2025	August 6, 2025
4. Adjustments and Modification	August 7, 2025	August 20, 2025
4.1 Report for reviewers	August 7, 2025	August 8, 2025
4.2 FGP Update	August 11, 2025	August 15, 2025
4.3 Second review by reviewers	August 16, 2025	August 20, 2025
5. Presentation to the Board of Examiners	August 21, 2025	August 28, 2025
5.1 Final review by the board	August 21, 2025	August 25, 2025
5.2 FGP Grade Report	August 26, 2025	August 28, 2025

20. Theoretical framework

20.1 Estate of the “matter”

Most science courses include laboratory components because students learn better by conducting experiments. However, traditional labs require resources, designated spaces, and lab technicians, making them expensive to maintain and challenging especially for online students (Sellberg, Nazari, & Solberg, 2024). Students often feel pressured to complete experiments quickly without making mistakes. This increases stress and affects their learning. Traditional methods also create a heavy workload for instructors who must grade numerous lab reports each semester (Formative, 2020).

Virtual laboratories are effective alternatives to traditional labs. They allow students to perform experiments repeatedly without extra costs or waste (Sellberg, Nazari, & Solberg, 2024). Studies show students using virtual labs achieve higher assessment scores and better understand concepts than those relying solely on traditional instruction (Bazie & Lemma, 2024; Beyond the Classroom Walls, 2023). The proposed IVSL design aims to address current challenges by providing engaging simulations while successfully integrating with the institution’s LMS. This approach promises better student learning outcomes, reduced instructor workload, and cost savings for institutions and students.

20.2 Basic conceptual framework

Project Management: The application of knowledge, skills, tools, and techniques to project activities to meet project requirements (PMI, 2021).

Virtual Laboratory: A computer platform allowing students to perform interactive science experiments online without physical lab equipment.

Digital Simulation: The use of software to recreate laboratory experiments in a virtual environment.

Learning Management System: Software used to deliver educational content, monitor student progress, and automatically grade assignments.

Self-paced Learning: An educational method where students learn at their own speed.

Interactive Learning: A teaching approach encouraging active participation and engagement.

Regenerative Development: A method focused on improving and sustaining educational, social, and environmental systems for long-term benefits.

21. Methodological framework

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
1. To create a Project Charter that formally authorizes the project and establishes its purpose and objectives.	Project Charter includes the project purpose, objectives, high-level requirements, assumptions, and stakeholder identification	Primary: Interviews with stakeholders Secondary: PMBOK Guide, articles	Inductive - Deductive	Project Charter Template, Expert Judgment Data Gathering, Stakeholder Analysis	Limited time and resources to complete the FGP within the assigned timeframe
2. To create a Scope Management Plan to define the project's scope, requirements, and deliverables.	Scope Management includes the Scope Statement, Work Breakdown Structure (WBS), WBS Dictionary, and Requirements	Primary: Surveys, focus groups Secondary: PMBOK Guide, textbooks, articles	Analytic-Synthetic	Scope Management Plan Template, Scope Statement, Work Breakdown Structure (WBS), Requirement Documentation,	Few case studies exist on virtual science labs in Belize or the region, making comparisons harder.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
	Traceability Matrix.			Requirements Traceability Matrix, Decomposition	
3. To create a Schedule Management Plan to outline the project timeline and key milestones for the design of the interactive virtual science laboratory.	Schedule Management- includes the project schedule, activity list, milestone list, schedule baseline, and control methods	Primary: Interviews with educators and IT experts Secondary: PMBOK Guide, project management textbooks	Statistical	Schedule Management Plan Template, Gantt Chart, Critical Path Method (CPM), Milestone Chart	Availability of interviewees or participants may delay some scheduled activities.
4. To create a Cost Management Plan to develop cost estimates and establish the budget for the design of the interactive virtual science laboratory.	Cost Management- includes cost estimation methods, cost baseline, and budget control processes.	Primary: Interviews with financial experts Secondary: PMBOK Guide, budgeting articles and textbooks	Statistical	Cost Management Plan Template, Cost Estimation Techniques (Bottom-Up Estimating, Parametric Estimating), Earned Value Management (EVM), Cost-Benefit Analysis, Reserve Analysis	Limited access to current financial data from similar virtual education projects in the country.

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
5. To create a Quality Management Plan to define quality standards and ensure the design meets educational and technological requirements	Quality Management Plan- includes quality objectives, quality control measures, and continuous improvement guidelines	Primary: Surveys and focus groups Secondary: PMBOK Guide, articles and textbooks on quality management	Inductive - Deductive	Quality Management Plan Template, Quality Metrics, Benchmarking	Some quality standards may require adaptation to a virtual environment.
6. To create a Resource Management Plan to determine and allocate the resources needed for the design of the interactive virtual science laboratory.	Resource Management Plan- includes the Resource Breakdown Structure (RBS), team assignments, and resource allocation strategies.	Primary: Interviews with technical specialists Secondary: PMBOK Guide, resource management textbooks	Analytic-Synthetic	Resource Management Plan Template, Resource Breakdown Structure (RBS), RACI Matrix, Organizational Breakdown Structure (OBS)	Some experts may have limited availability to provide input. Limited technical resources or access to software during the FGP research process.
7. To create a Communication Management Plan to establish how project information will be shared, ensuring clear and effective communication among stakeholders.	Communication Management Plan- includes the communication matrix, stakeholder communication needs, and reporting requirements.	Primary: Surveys, focus groups Secondary: PMBOK Guide, project communication textbooks	Inductive - Deductive	Communication Management Plan Template, Communication Matrix, Communication Requirements Analysis, Stakeholder Engagement Plan	Limited time and potential lack of engagement from participants may affect communication planning

Objective	Name of deliverable	Information sources	Research method	Tools	Restrictions
8. To create a Risk Management Plan to identify potential risks, assess their impact, and develop strategies to manage them	Risk Management Plan- includes the Risk Register, Probability and Impact Matrix, and Risk Response Strategies.	Primary: Consultations with educators and IT experts Secondary: PMBOK Guide, risk management textbooks	Statistical	Risk Management Plan Template, Risk Register, Probability and Impact Matrix, Risk Categorization	The unpredictability of stakeholder availability or digital access may present unknown risks.
9. To create a Procurement Management Plan to define the process for acquiring external resources and services required	Procurement Management Plan- includes procurement methods, contract types, and vendor selection criteria.	Primary: Interviews with procurement experts Secondary: PMBOK Guide, vendor selection articles and textbooks	Analytic-Synthetic	Procurement Management Plan Template, Contract Types, Source Selection Criteria	There may be limited availability of suitable local or regional vendors offering virtual lab-related tools or services.
10. To create a Stakeholder Engagement Plan to identify key stakeholders and define how they will be engaged throughout the project.	Stakeholder Engagement Plan- includes the stakeholder register, stakeholder influence assessment, and engagement strategies.	Primary: Interviews and stakeholder meetings Secondary: PMBOK Guide, stakeholder engagement articles	Inductive - Deductive	Stakeholder Engagement Plan Template, Stakeholder Register, Power-Interest Grid, Engagement Assessment Matrix	Different priorities among stakeholders may cause challenges

22. Validation of the work in the field of regenerative and sustainable development.

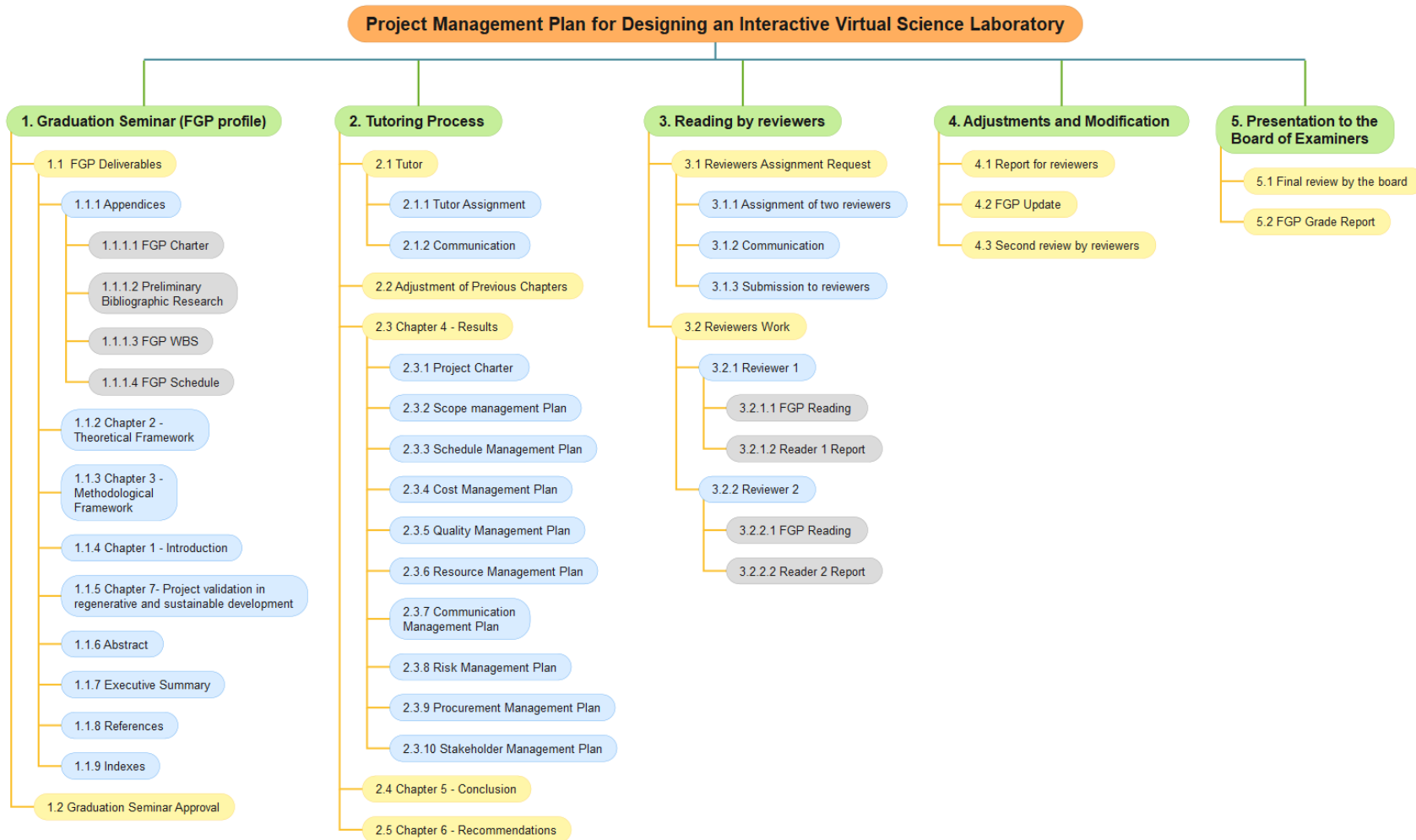
The Final Graduation Project (FGP) aligns closely with regenerative and sustainable development principles. It directly contributes to the United Nations Sustainable Development Goals (SDGs) such as providing quality education, fostering innovation and infrastructure, reducing inequalities, and building sustainable communities. By designing an Interactive Virtual Science Laboratory, the project aims to offer inclusive, accessible, and high-quality science education.

This type of learning aims to remove barriers caused by distance or financial constraints.

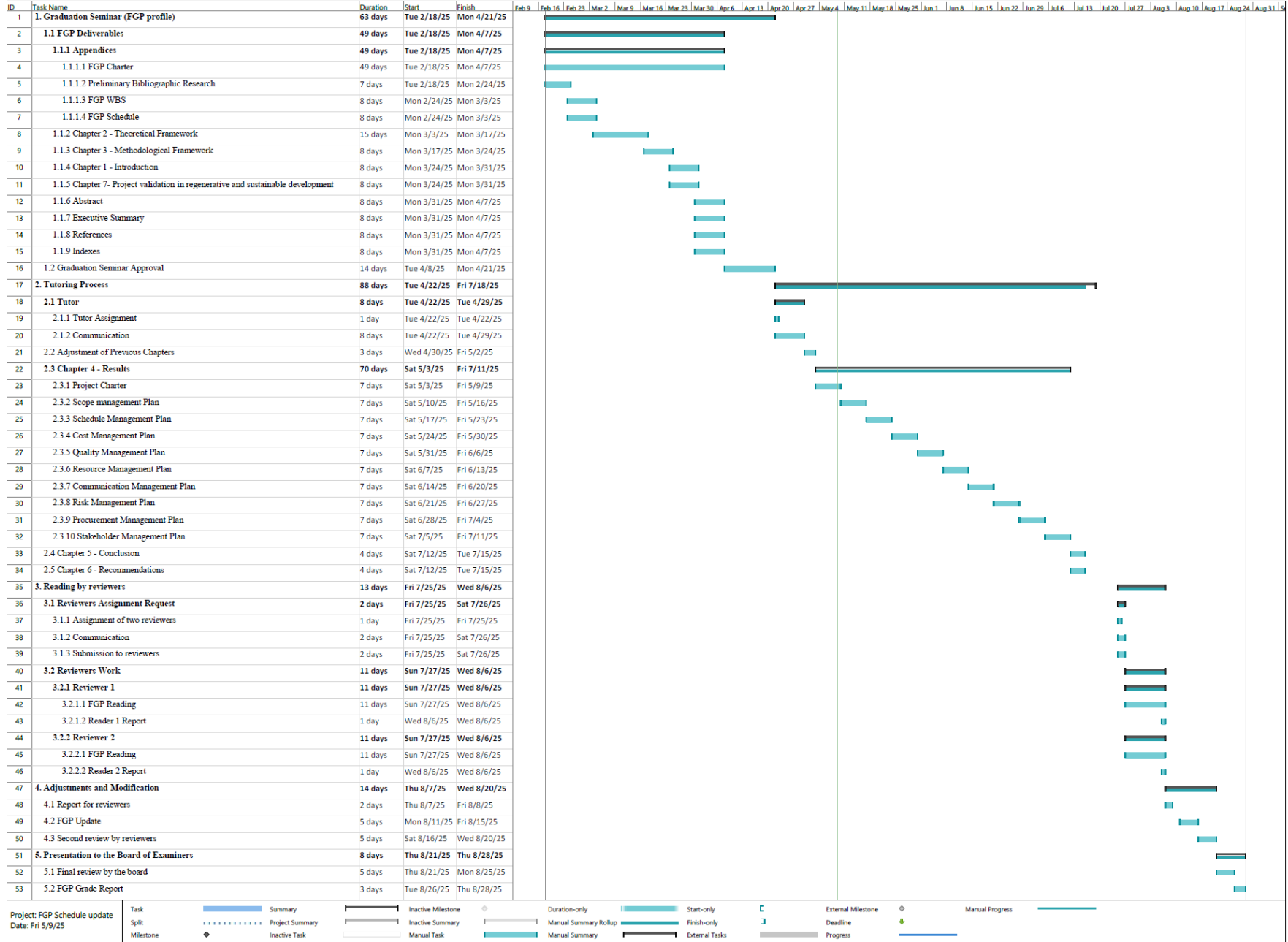
The proposed virtual laboratory supports regenerative development by enhancing students' engagement and understanding of science. This promotes lifelong learning and skill development. Because the lab is virtual, the project reduces reliance on physical materials and resources. This significantly reduces waste and energy use compared to traditional physical laboratories.

Indicators will help measure how sustainable and regenerative the project is. These indicators include the number of students using the virtual lab, how well students perform in assessments, and how satisfied they are with the learning experience. Other indicators include reduced usage of physical materials and less energy consumption. Teachers will also provide feedback on how effectively they can teach with this tool. Regularly tracking these indicators will ensure the project continues to support sustainable and regenerative goals.

APPENDIX 2: FGP WBS



APPENDIX 3: FGP SCHEDULE



APPENDIX 4: PRELIMINARY BIBLIOGRAPHICAL RESEARCH

Bazie, H., & Lemma, B. (2024). The effect of virtual laboratories on the academic achievement of undergraduate chemistry students: A quasi-experimental study.

JMIR Formative Research, 8(1), e64476. <https://formative.jmir.org/2024/1/e64476>

Justification: The reference above was selected because it provided strong evidence that virtual labs can improve student learning in chemistry. It demonstrated how virtual labs helped students understand concepts better than traditional methods. This study supports the idea that interactive virtual labs are effective educational tools.

Beyond the classroom walls: Utilizing remote virtual labs to enhance learning outcomes.

(2023). *Journal of Higher Education Applied Sciences*, 3(2), 351–369. <https://jhas-bwu.com/index.php/bwjhas/article/download/351/291/569>

Justification: The reference above was selected because it showed how virtual labs made learning more accessible. It explained how these labs engage students and provide flexibility. This study helps in understanding how virtual labs can be used effectively to enhance student learning outcomes.

Carboni, J., Duncan, W., Young, M., Pace, M., Gonzalez, M., & Smyth, D. (2024).

Sustainable project management: The GPM practice guide (3rd ed.). GPM Global.

Justification: The reference above was selected because it provides guidance on integrating sustainability into project management. It introduces principles that help ensure projects contribute positively to the environment and society. This will be useful in the FGP by supporting the alignment of the project with sustainability and regenerative development

principles. It also offers strategies for managing resources efficiently while considering long-term impacts.

Creating a Virtual Science Lab (VSL). (2018). *Smart Learning Environments*, 5, 9.

<https://slejournal.springeropen.com/articles/10.1186/s40561-018-0067-9>

Justification: The reference above was selected because it explained how to design an interactive virtual science lab. It described ways to structure remote experiments, so students remain engaged. This study is useful for developing a well-structured and engaging virtual science lab.

Design and implementation of virtual laboratories for higher education sustainability: A case study of Nankai University. (2022). *Frontiers in Education*.

<https://www.frontiersin.org/articles/10.3389/educ.2023.1322263/full>

Justification: The reference above was selected because it provided a real-world example of successful virtual lab implementation. It detailed the challenges faced and how they were overcome. This study helps in planning the design and integration of a virtual science lab.

Development and implementation of virtual physics laboratory: A case study. (2023).

CEUR Workshop Proceedings, 3679, 100–110. <https://ceur-ws.org/Vol-3679/paper10.pdf>

Justification: The reference above was selected because it explored how a virtual physics lab was created and tested. While it focuses on physics, the methods can be applied to other science labs. This study provides useful insights for designing interactive and accessible virtual labs.

Formative. (2020). Creating virtual science labs [Webinar]. Retrieved from

<https://training.formative.com/webinar/creating-virtual-science-labs>

Justification: The reference above was selected because it provided guidance on designing engaging virtual science labs. It focused on creating activities and assessments that keep students involved. This webinar helps in structuring interactive components of the virtual lab.

McGraw Hill. (2022). Virtual labs assessment. Retrieved from

<https://www.mheducation.com/highered/blog/2024/06/virtual-labs-assessment-3.html>

Justification: The reference above was selected because it explained how to assess student performance in virtual labs. It covered the best practices for designing pre-lab and post-lab questions. This resource is useful for ensuring the virtual science lab includes assessments that effectively evaluate student understanding and application of scientific concepts.

Meredith, J. R., Shafer, S. M., Mantel, S. J., & Sutton, M. M. (2020). *Project management in practice* (7th ed.). Wiley.

Justification: The reference above was selected for its practical project management applications, supporting the development of the Project Management Plan. It provides guidance on planning, scheduling, and resource allocation, ensuring the virtual science laboratory project is well-structured. Its focus on cost and risk management helps with budgeting and mitigating potential risks.

Project Management Institute. (2021). *A guide to the project management body of knowledge (PMBOK® guide)* (7th ed.). Project Management Institute.

Justification: The reference above was selected because it provides fundamental project management principles that support the development of the Project Management Plan. It offers guidance on key areas such as scope, schedule, cost, resource, risk, communications, procurement, quality and stakeholder management, ensuring the project is well-structured and effectively executed.

Science Interactive. (2023). Virtual labs vs hands-on labs. Retrieved from

<https://www.scienceinteractive.com/blog/2023/virtual-labs-vs-hands-on-labs-how-to-know-which-is-right-for-your-online-science-lab/>

Justification: The reference above was selected because it compared remote labs with traditional hands-on labs. It explained their advantages and limitations. This study helps in justifying why a virtual science lab is an effective alternative to physical labs.

Sellberg, C., Nazari, Z., & Solberg, M. (2024). Virtual laboratories in STEM higher education: A scoping review. *Nordic Journal of Systematic Reviews in Education*, 2, 58–75. <https://doi.org/10.23865/njsre.v2.5766>

Justification: The reference above was selected because it reviewed different types of virtual labs in STEM education. It outlined the best practices and common challenges. This study helps in refining the design of a virtual science lab by learning from successful models.

Shivam, S., & Wagoner, K. (2020). How well do remote labs work? A case study at Princeton University. *arXiv preprint* arXiv:2008.04499.

<https://arxiv.org/abs/2008.04499>

Justification: The reference above was selected because it evaluated remote labs in a university setting. It provided insights into student experiences and learning outcomes. This study is useful for understanding how remote labs can be effectively integrated into higher education.

APPENDIX 5: CHANGE REQUEST FORM

Change Request Form			
Project Name		Requested by	
Date of Request		Change Number	
Description of Change			
Impact of Change:			
☐ Cost	☐ Resource	☐ Scope	
☐ Quality	☐ Schedule	☐ Project Status	
Reason for Change Request			
Expected Effect on Deliverables			
Expected Effect on the Timeline			
Expected Cost of Change			
Status:			
Received On		Approved by	
Approved (Yes / No)		Approved on	[day/month/year]

Note. Own work.

APPENDIX 6: CHANGE LOG

Change Log						
Project Name				Updated On:		
Version No.				Review Date:		
Change No.	Change Request	Requested By:	Date of Request	Impact	Status	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Note. Own work.

APPENDIX 8: INTERNAL QUALITY AUDIT FORM

Audit Title / Reference	
Audit Date	
Auditor Name and Role	
Audit Scope / Phase	
Audit Method	
Reviewed Item or Area	
Quality Criteria / Standard	
Findings / Observations	
Compliance Rating (Compliant, Partially Compliant, Non-Compliant)	
Corrective Action Needed? (Yes/No)	
Corrective Actions (if any)	
Recommendations for Improvement	
Follow-up Date (if needed)	
Auditor Signature	
Project Manager Signature	

Note. Own work.

APPENDIX 9: LESSONS LEARNED LOG

Lesson Learned Log						
Project Name				Updated On:		
Version No.				Review Date:		
Log No.	Lesson Description	Contributor	Phase/Area	Recommendation	Status	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Note. Own work.

APPENDIX 10: INSPECTION REPORT LOG

Inspection No.	Date of Inspection	Deliverable / Component	Inspector Name & Role	Criteria / Standard	Method (e.g., test, checklist)	Findings	Pass/Fail	Corrective Action Required	Follow-up Date	Comments
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Note. Own work.

APPENDIX 11: PHILOLOGICAL DICTUM**Stephanie Flores Bradshaw**

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Academic Tutor
Master's Degree in Project Management
Universidad para la Cooperación Internacional
C. 35, Barrio Escalante
San José 10101
Costa Rica

July 13, 2025

Re: Philological Review of Final Graduation Project submitted by Aisha Marie Leiva in partial fulfilment of requirements for a Master's Degree in Project Management (MPM)

Dear Academic Tutor,

With this letter, I confirm that I have reviewed the Final Graduation Project (FGP) submitted by MPM candidate Aisha Marie Leiva entitled "Project Management Plan for Designing an Interactive Virtual Science Laboratory."

I hereby confirm that Aisha Marie Leiva has made all the corrections to the FGP as I have advised as philologist. It is my professional opinion that the document meets the literary and linguistic standards in written English as required for the MPM by the Universidad para la Cooperación Internacional.

Warm Regards,



Stephanie Flores Bradshaw
Philologist

Valdosta State University

This Certifies That
The Board of Regents of the University System of Georgia Upon Recommendation of the
Faculty of Valdosta State University
Has Conferred on

Stephanie Denise Flores-Bradshaw

the Degree of
Master of Arts
English

with all the Rights, Privileges, and Honors thereunto appertaining.
Whereof the seal of the University and the signatures of its duly authorized
officers are hereto affixed.

Given this thirtieth day of July, in the year of our Lord
two thousand and eleven

Henry M. Huchaby
Chancellor of the University System of Georgia

Michael A. ...
Dean, Division of Graduate Studies



James H. ...
President of the University

Stanley ...
Registrar