Unit 1

The project as a vehicle for problem solving

Getting started

The term ‘project’ is used in a variety of ways both within the formal education sector and in the wider society. In everyday life, we often use the term to refer to an activity that we have decided to engage in, either because we think that it will be of benefit to a specific group, or alternatively because we derive personal pleasure from it.

Projects are also a feature of the workplace as more and more these days, staff are being encouraged or even required to form themselves into teams to undertake special assignments.

Then there is the formal teaching-learning environment. Project work, constitutes one dimension of the overall teaching-learning strategy of an educational institution. It may be incorporated in a course of study, or it may be a stand-alone activity. However, even in that context, not all projects will be of the same type. Further, one can also find projects that are more informal in nature and not aligned to any aspect of the formal curriculum.

Our focus in this course is on the project that forms part of the formal study programme that students pursue. Further, we are looking at it exclusively as an activity to be used for addressing real-world problems.

While there may be some commonalities with the different types listed above, there are also important differences. Consequently, we first need to differentiate our view of a project from others that are also in use. Thereafter, we will go into more detail about the problem-solving feature that we are highlighting.

Learning Objectives

- Differentiate the project as a problem-solving tool from other types of projects.
- Identify and describe the key attributes of the problem-solving approach to project work.
- Clarify your understanding of the term ‘problem’ and identify other terms that share a similar meaning.
- Differentiate between everyday understandings of problem-solving and those that apply in the project-work context.
- Convert your initial problem idea into a question.
- Use the question to build the problem statement.
- Identify and describe the key features of the problem statement.
- Generate the project objective and establish its relationship with the initial question and the problem statement.

1.1 Distinguishing among different types of projects

Four come to mind, one from everyday usage, one from the field of project management and two others that are typically associated with teaching and learning in the formal education sector.

1.1.1 Everyday projects

We are referring to these as projects as distinct from ongoing tasks that are a part of the routine of everyday living. They are projects because they are based on a plan to achieve a clearly defined outcome, very likely within a particular time frame. Examples of such projects include

- running the football competition,
- organising a community clean-up campaign or
- planting a vegetable garden in your own backyard.

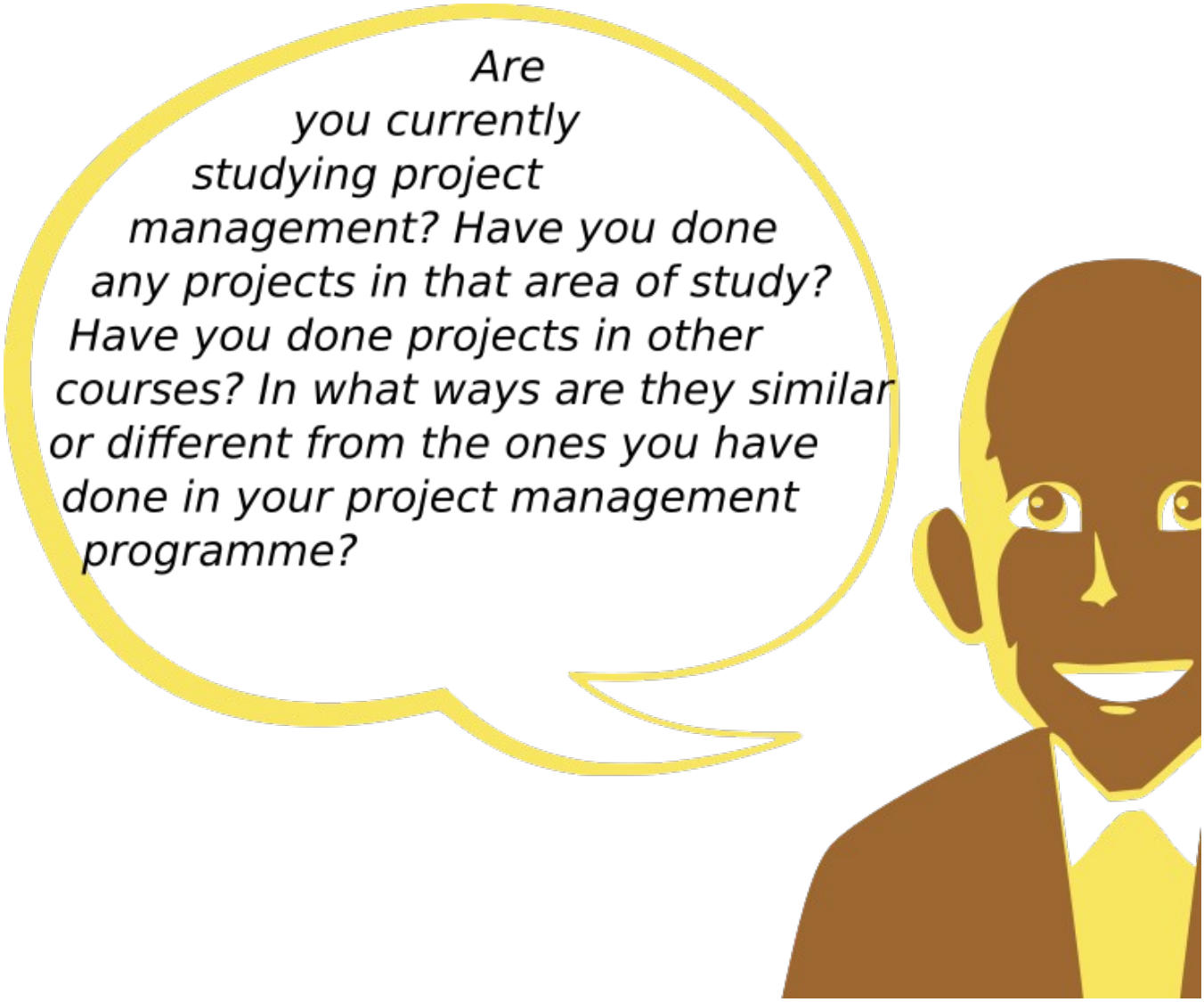
Almost invariably in these situations, the project is presented as something that has already been thought out and decided on. There may or may not be some rationale behind the decision, but if so, that is not usually highlighted. All of the focus is on the task to be accomplished and the need to harness all the necessary resources to get it done.

1.1.2 Projects implemented under project management umbrella

Some of you may be familiar with the use of the term ‘project’ in the field of project management. In that profession, there are certain clear attributes that define what a project is. For example,

- It is a series of related jobs or tasks, carried out in an organised manner to achieve a single objective or a single set of objectives
- It has a definite starting point and a definite completion time schedule; it is therefore a temporary activity.
- Its execution is subject to time, cost and other constraints: the resources available for implementing the project are always limited.

In that regard, project management is the process of planning, organising, controlling and measuring a project so that it could achieve its predetermined set of objectives.
Because of its significance in various professional management fields, project management has emerged as an important discipline in its own right within the formal tertiary education sector as the sector conducts training to satisfy the requirements of this aspect of the world of work. Some of you may be pursuing courses in this area of study and would therefore be undertaking projects in accordance with the relevant principles and procedures. Even though you may detect similarities with other learning activities bearing the name ‘project’, it would be appropriate to let your work be guided by the requirements of the discipline.



Something to think about

1.1.3 Two types of education-related projects not dealing with problem-solving

You will recall that we listed four terms that we will be using interchangeably in this course. They are *project, project activity, project work and project-based learning*. Moreover, whichever term we use, we are emphasizing the problem-solving aspect of their use. That focus still applies. However, there is an additional feature to the last of the four, *project-based learning*, that we want to draw attention to.

Project-based learning is the most recently coined term. While most educators who use the term view problem-solving as its primary purpose, there are a few that include other project-types under the umbrella of project-based learning. For example, Larmer (2014, updated 2015) views PBL as encompassing all three types of activities listed below:

- Designing and/or creating a tangible product, performance or event.

- Solving a real-world problem
- Investigating a topic or issue to develop an answer to an open-ended question.

In this course, we are joining with those theorists who keep the focus of PBL on problem-solving only. As such, we are excluding the other two. Let us briefly examine each of these before proceeding.

1.1.3.1 Designing a tangible product

In the first of Larmer's types, students are required to apply certain principles and procedures to create something tangible. Such projects are typically associated with science-based or engineering courses. The intention of such projects is to determine how well you have learnt relevant theoretical knowledge and more importantly how well you are able to apply that knowledge in order to create a pre-determined product. Conversely, the project may be intended to demonstrate whether, through the creation or construction of the product, you are able to identify the principles inherent in its design.

An example of this type of project was demonstrated in the Secondary Schools Annual Design and Build Competition held in Trinidad and Tobago, at the St. Augustine campus of the University of the West Indies (UWI) in January, 2019. This competition was a collaborative effort of the Institute of Structural Engineers (Caribbean Regional Group), the Association of Professional Engineers of Trinidad and Tobago and the UWI. Participants were required to design and build a model structure strong enough to withstand natural forces. View the media resource on the course page then attempt the SAE that follows. Even though we are not dealing with this type of project, doing the exercise should be beneficial.

Resource material 1.1
Videoclip of Design and Build Competition, UWI, St. Augustine, Trinidad and Tobago, January, 2019.

Self-assessment exercise 1.1
In two or three sentences describe the task participants were required to undertake and the objective they were expected to achieve. As far as you are able to discern from this short video clip, (or from your own knowledge) were there any particular principles and/or concepts that participants were expected to be aware of as they undertook the task?

1.1.3.2 Investigating an open-ended topic or issue

The third of Larmer's types can also be described as an extended essay or assignment. It is based on a topic or an issue of a fairly complex nature that requires thorough, comprehensive treatment. One important feature of such a project is that the topic is fairly open-ended, thereby giving students a certain degree of freedom to determine how they would approach the task. Students are also required to do extensive research covering a wide body of literature ranging from the theoretical to more popular, everyday information sources. The literature

search would be guided by a clear analysis of the topic, to identify subtopics and establish the relationships among them. Given the scope of the assignment, it can be expected to be between 5,000 and 10,000 words in length. Following is an example of a topic for this type of project:

> In the preamble of its 2001 Human Development Report, the United Nations Development Programme (UNDP) asserts, “throughout history, technology has been a powerful tool for human development and poverty reduction”. Critique this assertion with reference to any geographical region (or sub-region) of the world.

Again, even though this type of project is excluded from the course, it may be useful to attempt the SAE below.

Self-assessment exercise 1.2
Without getting too deeply into the topic, list some subtopics that you will use to do your planning as well as conduct your literature search if you were required to undertake this assignment.

We have identified these four types of projects to ensure that you are able to set them aside as we embark on the type we will be focusing on in the rest of this course, and which we view as being sufficiently different in terms of its purpose to warrant its own treatment.

1.2 Project work as problem-solving: what the theorists say

Several theorists and practitioners concur that the primary purpose of project work is to engage students in the task of solving problems, and more specifically real-world problems.

Helle, Tynjola and Olkinuora (2006), drawing on the work of an earlier theorist, state, “projects involve the solution of a problem; often, though not necessarily, set by the student himself [or herself]” (p. 288). Taking the definition further, and using the more focused term, *project-based learning (PBL)*, the authors add, “the most distinctive feature of project-based learning is problem orientation, that is, the idea that a problem or question serves to drive learning activities” (p. 290).

Another theorist, Thomas (2000) emphasizes the real-life dimension of the problem-solving activity when he asserts, “PBL incorporates real-life challenges where the focus is on authentic (not simulated) problems or questions and where solutions have the potential to be implemented” (p.4). The term ‘authentic’ holds special significance here as it underscores the role that projects play in taking students beyond the structured, well-planned learning experiences of the classroom, into the real world in order to treat with problems as they actually exist and are experienced in the spaces within which they emerged.

However, even as he highlights the focus on authentic real-world problems, Thomas also recognizes the role of theoretical knowledge in project-based learning.

Citing earlier theorists, he makes the point that projects must be “crafted in order to make a connection between activities and the underlying conceptual knowledge that one might hope to foster” (p.3). His overarching position is, “PBL projects are focused on questions or problems that ‘drive’ students to encounter (and struggle with) the central concepts and principles of a discipline” (p. 3).

Two points are to be noted about the above. The first is the idea of the problem ‘driving’ the learning activities. The term ‘drive’ is significant as it moves the act of learning out of the realm of students’ simply reproducing information that was previously learnt to one where they must actively engage with the problem and allow their learning to emerge out of the encounter with it.

The second is that PBL seeks to achieve its goal of understanding and finding solutions to problems by looking at them through the lenses of the theoretical knowledge that professionals develop over time based on their study the real-world. Recall Thomas’ (2000) assertion that problems drive students to encounter ‘central concepts, themes and principles of the academic discipline’. One of the key challenges of undertaking a project activity is for the students to be able to illuminate the study of the real-world issue through reference to a formal body of knowledge. Failure to do so can result in students reproducing their own (often limited) awareness of the problem, thus restricting their ability to examine it in sufficient breadth and depth.

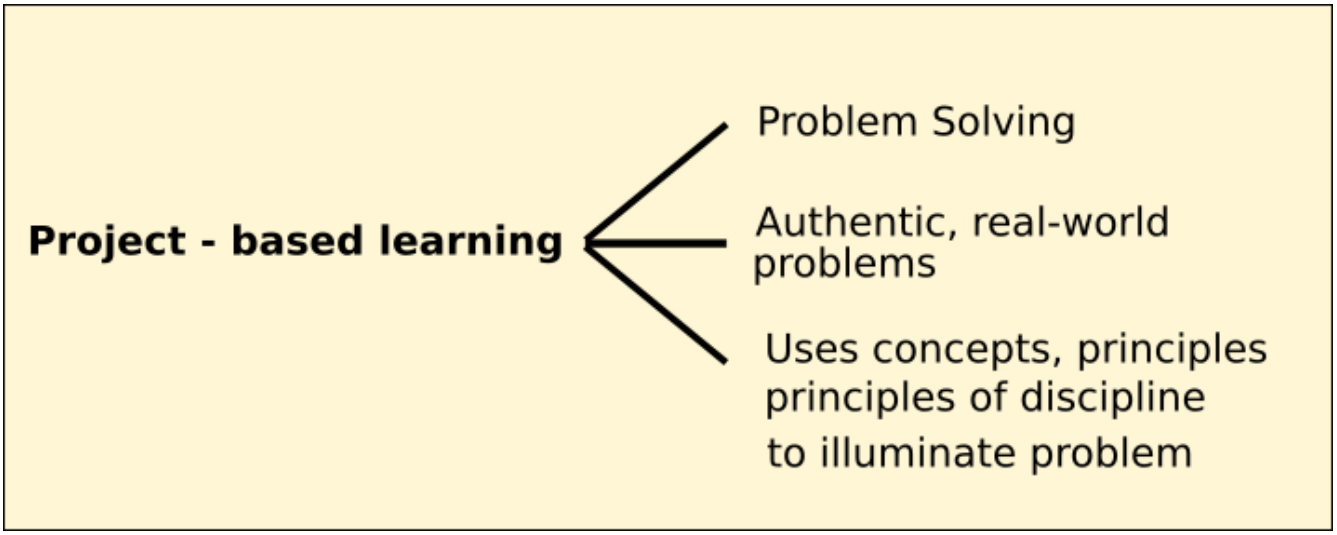


Figure 1.1 – Project-based learning

Self-assessment exercise 1.3

In no more than a single phrase or sentence, identify and briefly describe about five real-world problems that, in your view, should be addressed. They may or may not be linked to the courses you are studying. This is a first step in developing your project. We will return to this list at various stages as we progress through the course.

1.3 What exactly is a problem, and what is problem-solving?

The Cambridge Dictionary defines a problem as “a situation, person or thing that needs attention and needs to be dealt with or solved”. The Collins English Dictionary is more to the point: it defines the term as “a situation that is unsatisfactory and causes difficulties for people”.
Using these definitions as a launching pad, we can think of a problem as some situation or happening that negatively impacts how some aspect of the real-world environment functions or exists. With that interpretation in mind, I am proposing the following as problems since they are having a negative impact in some real-world context:

- A decline in tourist arrivals in the country
- Disruptive classroom behaviour.
- Yearly flooding in Community X during the rainy season.

Something to think about

While this interpretation of ‘problem’ is the typical one in project work, some practitioners also think of a problem as a gap between what is and what could possibly be. They view the gap as a signal of how the status quo could be enhanced or improved. The gap arises when there is an idea of moving from what is to a more advanced state of being or operating.

Technology is one area where gaps may be observed. Improvements in telephone communication, in motor vehicles, in household appliances are largely driven by ideas to take what exists to a higher level. However, such thinking is not restricted to the development of more advanced products. Newer processes, procedures and

operations may also emerge in this way: the advance in the information and communication technologies (ICTs) opened the way for educators and other professionals to move beyond the technologies of print and broadcast media for the delivery of distance education and take advantage of the interactive and distributed nature of the more advanced ICTs.

This approach was evident in the launch of an online fundraising platform catering specifically to some sectors of the Trinidad and Tobago population. The developer was of the view that the existing fundraising practices in the country were inadequate and therefore he introduced a tool that he saw as being more effective for the task. According to a newspaper report, he explained his decision this way:

> FundMeTnT was created with the idea to provide a simple and easy-to-access platform that would not only making (sic) charitable and community giving easier for those who lead busy lives but want to contribute, but also serve to create a wider pool of donors beyond persons who would trek down to the bank to do cash deposits. (https://newsday.co.tt/2018/11/08/digital-charity/)

Resource material 1.2
Khan, K.A. *Digital charity: FundMeTnT*, online platform to help worthy causes. Trinidad and Tobago Newsday, Thursday 8 November, 2018.

Self-assessment exercise 1.4
Read the entire newspaper article about FundmeT&T (see link above). Identify the existing fundraising practices that the developer considered inadequate. Keeping in mind that this is a short newspaper article, are you satisfied that he has made a reasonable case for introducing the online platform? What other areas, if any, do you think would strengthen the case for the final decision made?

1.3.1 Other terms used alongside ‘problem’

There are a few other terms that you will encounter depending on your area of study, which serve similar purposes as the term ‘problem’ in the project work context. See if you can detect some in this excerpt from Bell (2010) that looks at classroom practice in primary education. She states,

> Learners pursue knowledge by asking questions that have piqued their natural curiosity … the genesis of a project is an inquiry … Many inquiries are science-based or originate from current social problems … Children solve real-world problems by designing their own inquiries. (p.39).

There are two terms of note here. The first is ‘question’. Recall that we saw it earlier when Helle et al used it interchangeably with ‘problem’. The second is ‘inquiry’, which is the name given to the activity that children undertake when they solve problems.

A third term, which also features in the field of education, is ‘action research’. One educator explains as follows:

> Action research, also known as teacher research or teacher inquiry, is an uncomplicated but powerful initiative that teachers can take in their own classrooms to enhance their effectiveness and improve student learning …
>
> Teacher action research is based in schools. … The process generally involves the teacher’s identification of a classroom **issue** and the development of a research question. Ideally, the issue or problem is one “owned” by the teacher, and change is within the teacher’s authority, should the research indicate that change is warranted. **(Emphasis mine)**. (Levin, 2006, p. 19).

In the context of this course, we regard the terms mentioned above as having a meaning similar to that of ‘problem’.

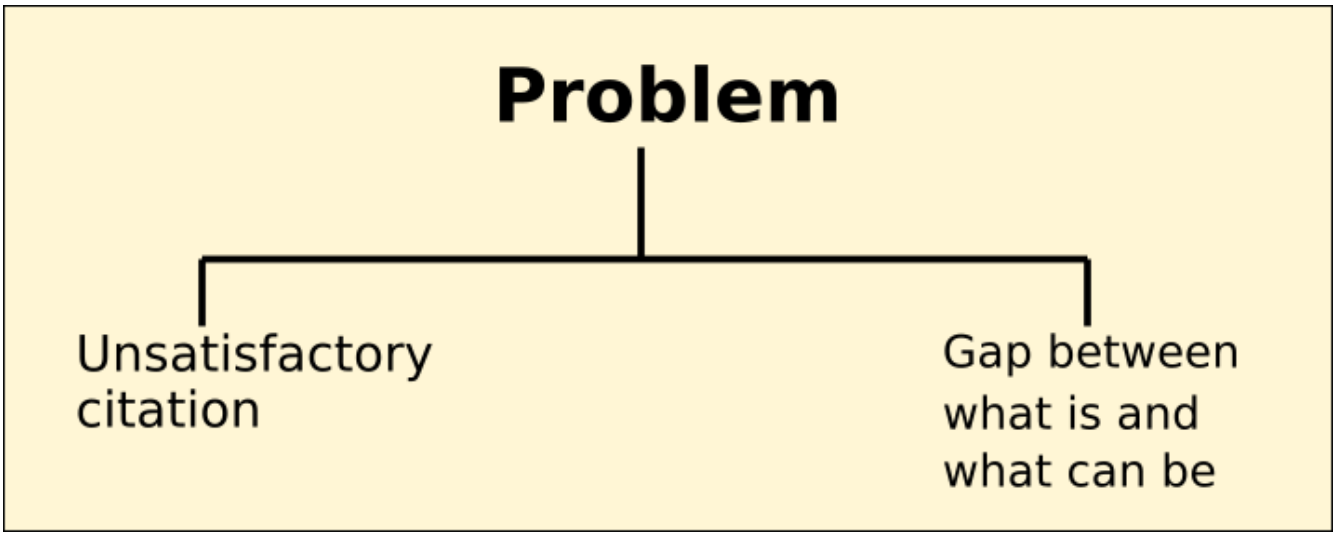


Figure 1.2 – The Problem

1.3.2 Problem solving – a two-part exercise

Now that we have clarified our understanding of the term ‘problem’, what about problem-solving? What do we mean when we talk about solving a problem? We should be cautious about transferring our everyday views about solving problems to the project-based learning context. Our typical interpretation of the phrase ‘to solve problems’ emphasizes the need to arrive at a solution, to get an answer. Having arrived (hopefully) at the correct answer, the problem no longer exists. This tendency towards getting an outcome that would eliminate the problem situation, shows itself up in at least two ways.

First, it is a requirement of some of the courses you study, for example mathematics and some of the sciences. The path towards arriving at that point, even though important, is secondary.
One blogger views it this way:

> It comes as no surprise that we naturally fall into solution mode. We have been hardwired to problem solve since day dot. Think of the binary characteristics of all the exams and tests you have ever taken. You are given a problem that you are *required* to answer. Whilst it may be comforting to ponder about the problem, when the clock puts the sweat on you, it is time to quickly and efficiently solve the problem. (Moen Lee, April 2016)

In other instances, you feel that you must give advice about how to correct an unsatisfactory situation. Many times, what happens is that your own previously held concerns about the problem and your anxiety to fix it and make things better for all concerned, get the better of you. Then before you know it, you are expressing some strong opinions about the situation, which probably you have not really thought through clearly. Then, on the basis of those opinions, you proceed to make recommendations and even persuade others to act in ways that you consider to be appropriate. If you find yourself using phrases such as what people must, have to, need to or ought to/should do, or alternatively, what must be done, should be done, then you are on the wrong track. You are looking for a quick fix. Any tendency towards getting a premature solution should be avoided at all cost.

In the context of project-based learning, we want to curb the tendency to rush towards an outcome without fully understanding what the problem actually is. For that reason, in this course, we are emphasizing the need to view problem-solving as a two-part exercise. We are making a distinction between investigating the problem, that is, getting a clear understanding about what it is, and developing a solution for the problem, that is, formulating a response to alleviate the problem situation.

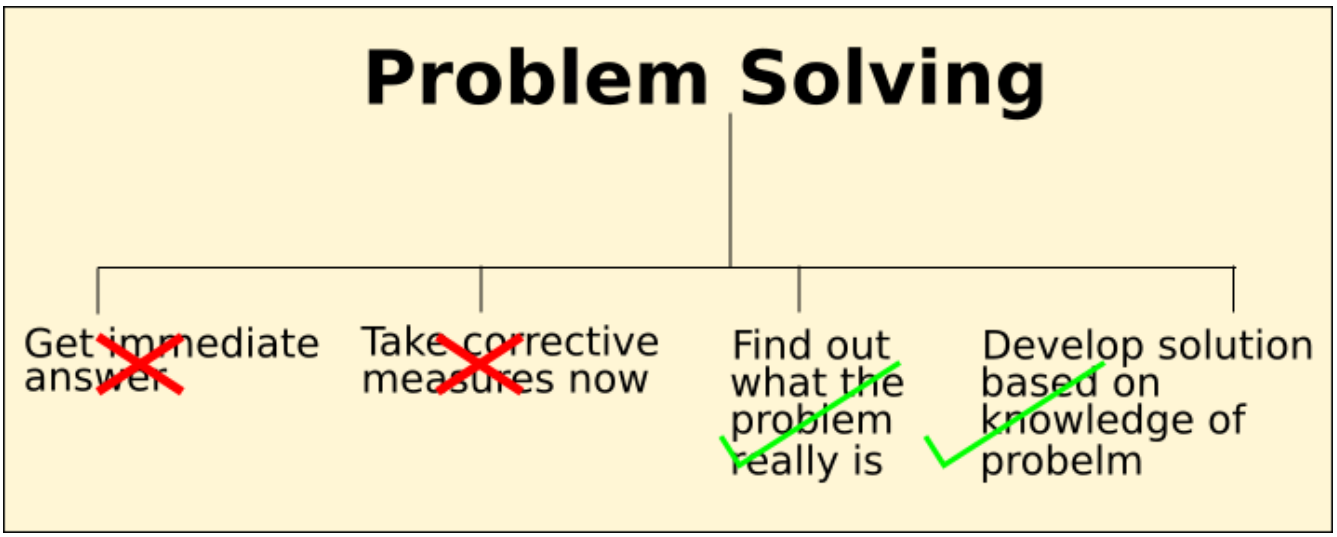


Figure 1.3 – Problem Solving

While not excluding the second, we will be focusing on the first part of the exercise in the rest of this Unit and continuing to Unit 3. In Unit 5 we will turn attention to the second part. This is a conscious decision on our part, given the tendency among students to overlook the investigating aspect of the problem-solving exercise.

Self-assessment exercise 1.5
Do a second review of your list of problems. Given the emphasis on investigating that I just mentioned, look carefully at your list and ensure that what you have described are problems as they exist and not solutions that you think ought to be implemented.

1.4 Developing the problem statement and project objective

Earlier, we identified three possible problems that we thought could be addressed through a project. These were:

- the decline in tourist arrivals,
- disruptive classroom behaviour and
- perennial flooding in the community

However, looking at them a second time, it is clear that they are basically preliminary thoughts or ideas of what we consider to be unsatisfactory. To move forward, we have to do some refining. What exactly do we want to do about these problems?

1.4.1 The question

Project activity requires that we develop a problem statement. However, before we can begin that task, we need to clarify what exactly we want to do with the problem. Do we want to get more information about it or do we want to find a solution for it? Recall that the project can take either of these two problem-solving routes. However, as stated earlier, we are concentrating on getting a fuller understanding of the problem. We must therefore specify what we intend to do in clearer terms and we do so by formulating a question to guide us as we pull our thoughts together to come up with a broader statement about the issue of concern. Let's generate questions for each of the problem ideas previously identified.

Decline in tourist arrivals:

- Why has there been a decline in tourist arrivals in Country X?
- What are the factors contributing to the decline in tourist arrivals in Country X?

If you look closely, you will realize that these two questions are similar. Different forms of language use but both seeking the same information.

Disruptive classroom behaviour

- How widespread is disruptive classroom behaviour in School Y?
- What reasons do students give for being disruptive in class?
- What effect does the disruptive behaviour in Class B have on students who do not consider themselves disruptive?

These are three completely different questions and naturally, they will take us along different paths for examining the initial problem idea. They are also targeting different groups within the classroom setting. In addition, each may require the use of a different instrument when the project reaches the stage of data collection.

Perennial flooding in the community

- How are the lives of residents of Community P impacted by persistent yearly flooding?
- What steps do residents of Community P take to minimise the effects of the perennial flooding on their lives?

One common feature of all the questions above is that they are all seeking information on a single issue. None of them are double-barrelled questions. For example, we did not ask about the frequency of disruptive behaviour in classes and reasons students give for being disruptive as a single question. Combining two or more issues into a single question should be avoided at all cost, even if the issues pertain to the same problem idea. That will just make the exercise complicated and undermine your attempts to arrive at the best possible outcome.

Another point to be noted is that the questions listed above are at different levels of difficulty. For example, the question about the prevalence of disruptive behaviour in the school is seeking more basic information than the one inquiring about the effect of the behaviour on other students. That notwithstanding, one should be aware that, however simple a question may appear on the surface, a closer examination would reveal how multi-dimensional it is. We will return to that later.

Self-assessment exercise 1.6
For each of the problem ideas you listed in SAE 1.3, create a question that reflects your interest in and/or concern about this problem idea and which you will use as a guide to formulate the problem statement.

1.4.2 From question to problem statement

The problem statement is a fairly detailed account that provides a fuller description of the problem. It should be broad, and incorporate information from as many angles as possible. It is the question that you will be using to guide the process of formulating the problem statement, which should be no more than about one to two pages long.

You would want to start the statement with your own observations and/or experiences about the existence of the problem. Since you are the one undertaking the project, you would want to demonstrate that you are qualified to do so. You should therefore introduce the section with one or two pieces of evidence to show that you are familiar with the issue.

To strengthen your position that this issue deserves attention, you would also include the perspectives of others, for example ordinary individuals writing letters to the editor, persons holding official positions who are appropriately placed to give an informed view. You may also be able to locate reports of research studies that underscore the need for the investigation. There may also be official reports (from government and other public agencies) outlining initiatives taken in the past to address the problem and the outcomes of those initiatives. You should note though that you may not be able to find information that directly addresses the issue of interest to you. Nonetheless, you may be able to locate related information on the broad problem area (for example, general information on flooding) and you can draw on this to throw light on your specific concern.

One important feature of all the sources referred to above is that they provide first-hand information about the issue you are dealing with; they have a direct connection to the real-world situation.

1.4.3 The project objective

Having developed the problem statement, in which you laid out the case for conducting the inquiry, you will now set out the objective that you want to achieve from undertaking the project. Ending the problem statement with a clearly written objective, ensures that you remain focused on the intended outcome. Actually, there are no surprises about this aspect of the exercise. The objective will emerge logically from the problem statement, which in turn, was guided by the question you set yourself, based on the initial problem idea. In essence therefore, the objective is a re-fashioned version of the starting question. Following are objectives that were developed in relation to each of the questions listed above.

Decline in tourist arrivals:

Questions:

- Why has there been a decline in tourist arrivals in Country X?
- What are the factors contributing to the decline in tourist arrivals in Country X?

Objective:

- The objective of this project is to investigate the decline in tourist arrivals in Country X.

Disruptive classroom behaviour

Questions:

- How widespread is disruptive classroom behaviour in School Y?
- What reasons do students give for being disruptive in class?
- What effect does the disruptive behaviour in Class B have on students who do not consider themselves disruptive?

Objectives:

- The objective of this project is to determine the extent of disruptive classroom behaviour in School Y
- The objective of this project is to investigate the reasons students give for being disruptive in class.
- The aim of this project is to ascertain the effect that disruptive behaviour in a class has on students who do not consider themselves to be disruptive.

Perennial flooding in the community

Questions:

- How are the lives of residents of Community P impacted by persistent yearly flooding?
- What steps do residents of Community P take to minimise the effects of the perennial flooding on their lives?

Objectives:

- The objective of this project is to assess the impact of persistent yearly flooding on the lives of the residents of community Y.
- The aim of this project is to examine the steps that residents of community Y take to minimise the effects of the perennial flooding on their lives.

Self-assessment exercise 1.7
At this juncture you will temporarily put aside the exercise you have been working on up to this point and review a problem statement and project objective taken from a research study. This study was submitted by its author as partial fulfilment for the award of M.Sc. at the Kwame Nkrumah University of Science and Technology in Ghana.

It is not a project, but as you will soon realise, both a project and a research study comprise similar core components, even though the research study is a more advanced form of academic inquiry.
Read Chapter 1 of the research study (Resource material 1.3), then pay special attention to the problem statement and objectives. After reviewing those two segments, answer the following questions:

- *Do you detect any evidence that suggests that the author has personal knowledge of the problem he is describing?*
- *What are the different types of information that the author uses to strengthen his position regarding the problem?*
- *Are you able to make links between the statement and the research questions?*
- *Are you able to detect the connection between the research questions and objectives?*

Resource material 1.3
Adams, A.G. (June 2008). Perennial flooding in the Accra Metropolis: the human factor.

Thesis submitted to the School of Graduate Studies, Kwame Nkrumah University of Science and Technology, Kumasi-Ghana, in partial fulfilment for the award of Master of Science.

As you complete this exercise, there are a few things to note before moving forward.

As noted earlier, the research study is a more advanced form of academic inquiry than the project.

- A research study will typically be based on multiple objectives rather than a single one.
- While the research questions of the research study provide the basis for generating the objectives, the latter do not necessarily mirror the former in a direct way.
- Data collection and analysis methods for the research study are more complex.
- The literature review of the research study is more extensive and more in-depth than the information gathering exercise of the project.

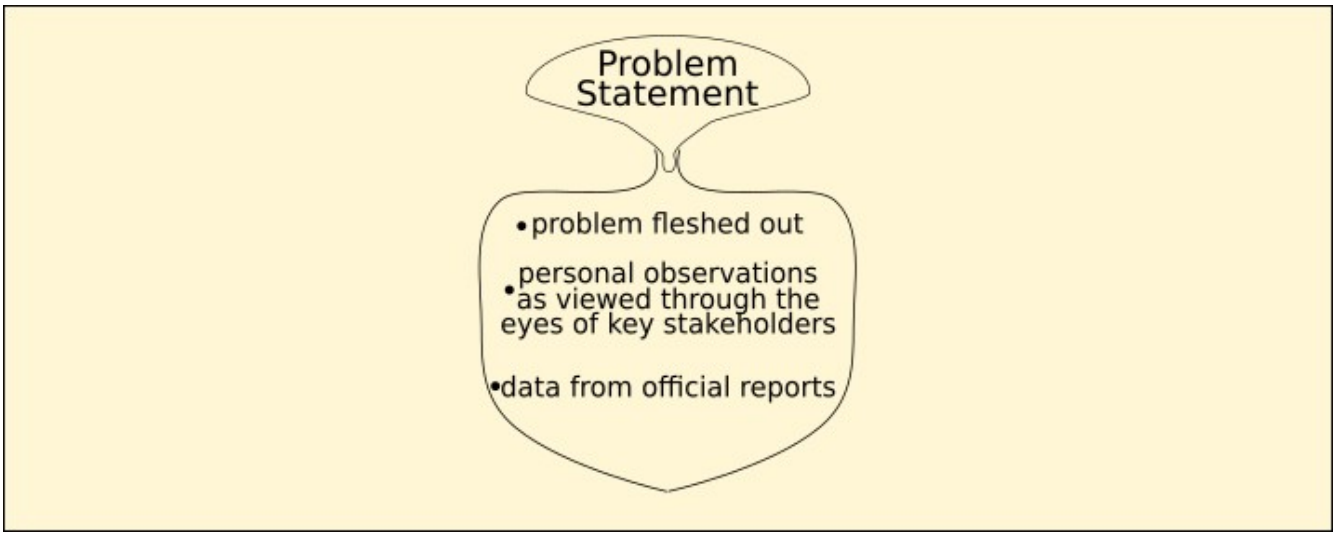


Figure 1.4 – Problem Statement

Self-assessment exercise 1.8

You will now return to the project activity you began earlier. Select any one of the questions you developed from your original problem ideas and prepare an appropriate problem statement of no more than two pages. You will follow up the statement with the project objective. Even though you are proceeding with only one problem/question, you may, if you wish, make adjustments to any of the others.

Key Takeaways

- Examples of project excluded from this course: everyday projects; project-management type; design and build; assignments based on open-ended topics.
- Key features of projects based on problem-solving:
  - Learner-driven
  - Problem – authentic
  - Real-world experience viewed through lens of theoretical knowledge.
- Explanation of 'problem' – unsatisfactory situation; gap.
- Problem solving – investigating problem; developing a solution.
- Question developed to refine problem idea.
- Problem statement created to flesh out question, using information from sources with direct connection to problem.
- Problem statement presents view of problem from different angles.
- Project objective generated from question and problem statement.