TSSM™
Creating VCE Success

Software Development
Teach Yourself Series
Topic 1: Problem Solving Methodology

Contents

Problem Solving Methodology

The problem solving methodology is used throughout the Computing study design. It refers to the steps taken to solve an information problem.

There are four parts of the problem solving methodology. Each of these will be looked at in detail.
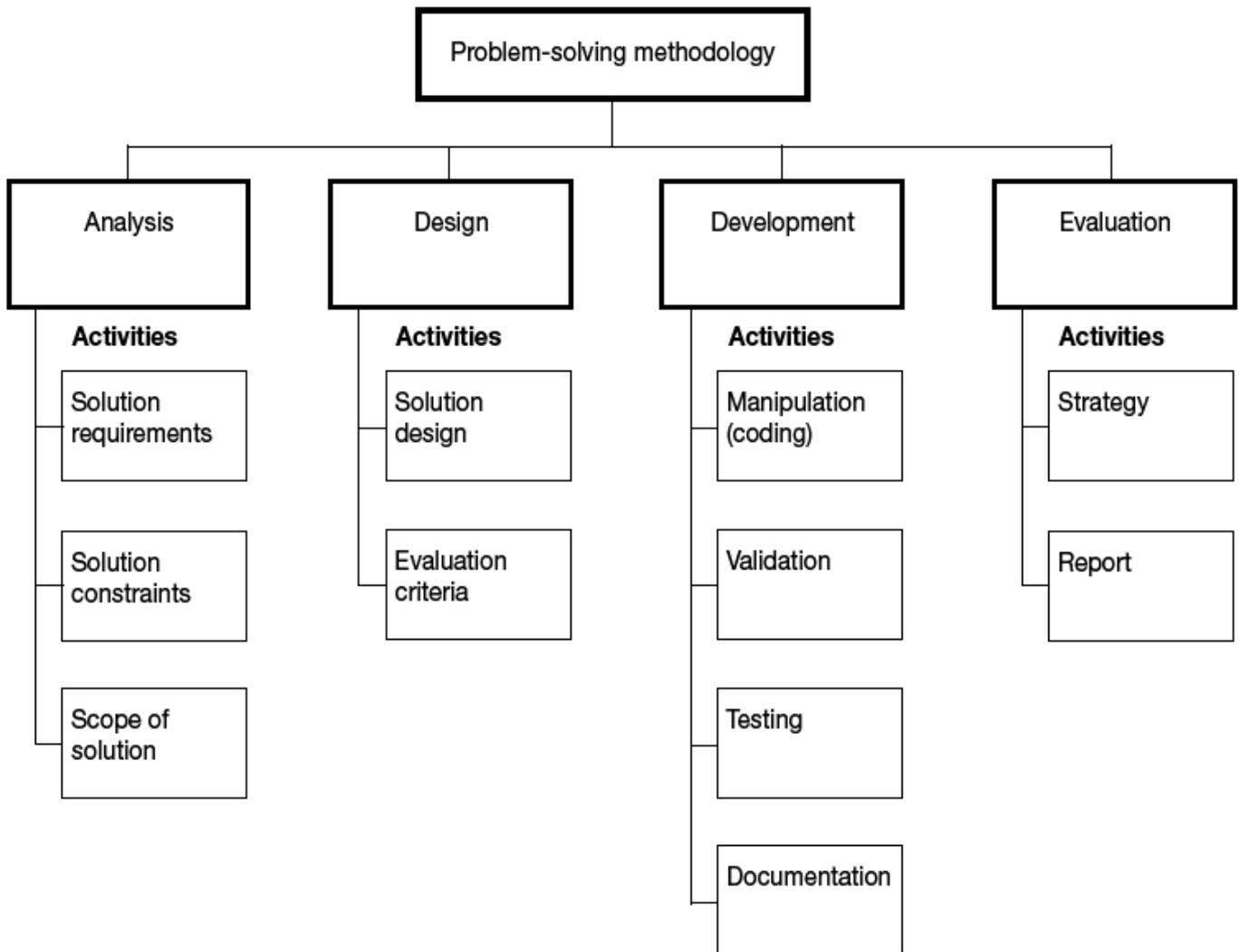
Source: VCAA Information Technology Study Design

Analysis

As it appears in Units 1-4

Analysis is the first stage of the problem solving methodology. Analysis involves the investigation that must be completed before an information problem can be resolved. This stage usually focuses on the 'what' questions:

- What will solve a problem?
- What benefits will the solution provide the user?

This stage involves examining what the problem is, why it exists, determining how the current system works and whether the problem will be able to be solved. During this stage, it is also necessary to identify any constraints that will impact the ability to complete the project and developing a logical design describing what the finished product will be able to achieve.

Understand the problem

In order to solve an information problem, it is helpful to understand why the problem has occurred. This could be due to:

- Inefficiencies
- Incorrect data or information
- Technology issues such as old technology

Determine the solution requirements

Now that the problem is understood, you must determine what needs to be done to solve the problem. Determining the solution requirements includes:

- Understanding the information the solution must provide
- The data that is needed to produce the information
- The functions that the solution requires

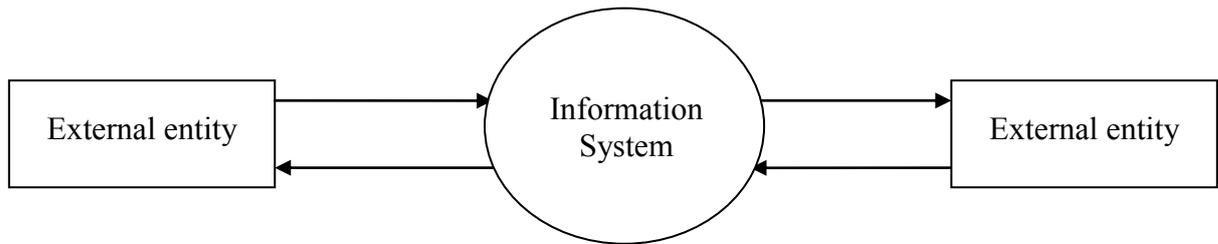The requirements may be functional or non-functional.

- Functional: what the solution is required to do
- Non-functional: the attributes of the solution such as user friendliness, reliability portability, robustness and maintainability.

Tools that can be used to help determine the solution requirements include:

- **Data flow diagrams**: used to show the content and direction of data in an information system.
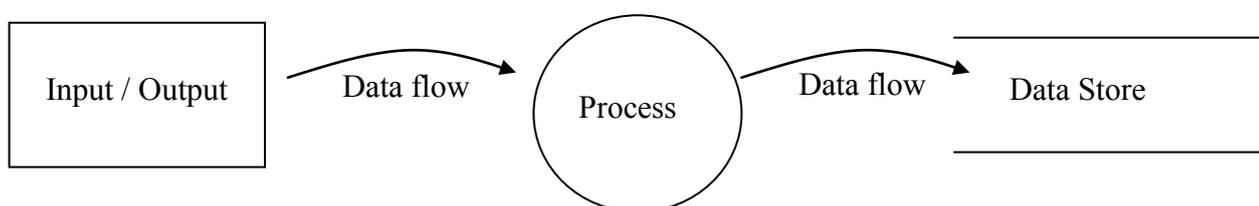
- **Context diagrams**: high level view of the entire system and how it relates to the external systems.

- **Use cases**: plans to help visualise the system's functional requirements.

| Actor | Use case | Association | Includes/extends |

System boundary
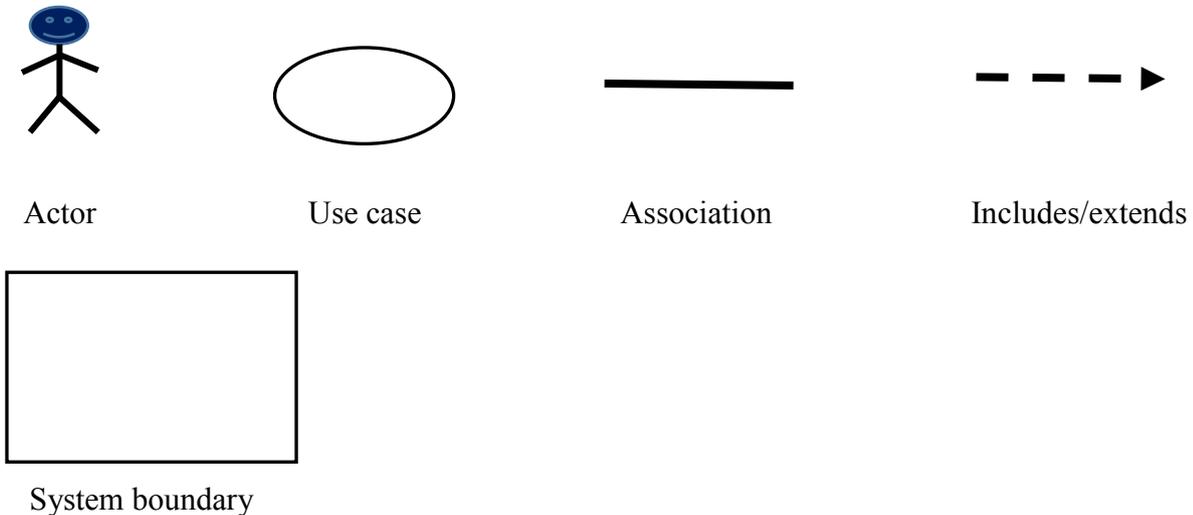
Identify the constraints on the solution

Constraints refer to the restrictions that need to be considered when designing a solution. Constraints may include:

- Cost
- Speed of processing
- Requirements of users
- Legal requirements
- Security
- Compatibility
- Level of expertise
- Capacity
- Availability of equipment

Determining the scope of the solution

Scope refers to the boundaries or parameters of the solution. Scope should consider:

- What the solution can do
- What the solution cannot do
- What are the benefits to the user in terms of both efficiency and effectiveness

Review Questions

1. Customers of a bank are receiving letters addressed to other customers. What is the most likely reason for this information problem?
   A. Inefficiency
   B. Incorrect data or information
   C. Technological issues
   D. Orientation

2. Which of the following is an example of a functional requirement?
   A. The solution must be easy to use
   B. The solution must be easy to maintain
   C. The solution must be able to record customer details
   D. The solution must be dependable

3. Which of the following is not a constraint on the solution?
   A. The client is willing to spend up to $50,000 for the solution to be created
   B. The users of the system have only basic computer skills
   C. The client has one file server and five workstations
   D. The client cannot be contacted on Sundays

Design

As it appears in Units 1-4

The design stage involves determining the way the problem will be solved. This is where the logical design is transformed into the physical design, describing exactly how the system will work. During this stage it may be necessary to create mockup diagrams showing images of what screens will look like and plan how the system will be tested. There are a number of design tools that could be used including data structures, flow charts, data dictionaries and IPO charts. The tool used will depend on the solution being created.

The solution design involves:
- Identifying the data is required
- Determining how the data will be named, structured, validated and manipulated
- Showing how each part of the solution related to other parts
- Determining the appearance of information generated from a solution
- Determining the evaluation criteria

Design tools used will vary depending on the type of solution that is being required. These are outlined below according to the type of solution.

- **Flowchart**: Outline a sequence of events in a process.
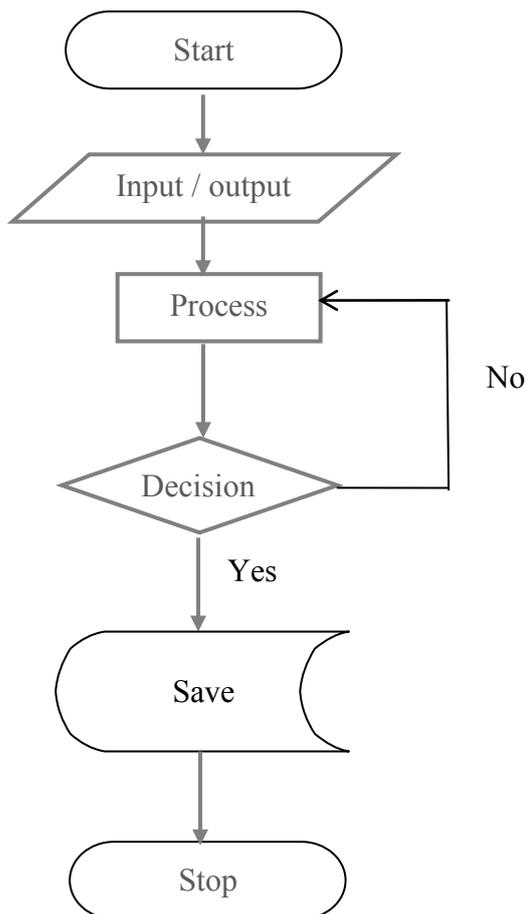
Input Process Output (IPO): Identifies the data that will be input into the system, then manipulation in order to produce the required output.

Input	Process	Output
Each student score	Add all students scores Divide by total number of students	Average class score

- **Pseudocode**: structured English that is not in programming language, but helps to outline what the program will do with the data to produce the necessary functionality. Pseudocode is used independently from any program language.

```
Start
    sub count students
        create array for the class
        loop through array
            for each loop add another student
            end loop
    end sub
Stop
```

Review Questions

4. What is the difference between a rectangle and a diamond in a flowchart?
   A. A rectangle represents a process while a diamond represents a decision
   B. A rectangle represents an input while a diamond represents a decision
   C. A rectangle represents a process while a diamond represents an output
   D. A rectangle represents a decision while a diamond represents a process

5. The pseudocode used will change depending on which programming language is being used.
   A. True: each programming language has its own pseudocode
   B. False: it shouldn't matter which programming language is going to be used
   C. Sometimes: There is one pseudocode for Visual Basic, but each other programming language uses the same pseudocode
   D. All of the above

Development

As it appears in Units 1-4

The development stage involves the manipulation of data to produce the solution, validation of data being input, testing whether the solution does what is intended and writing documentation.

Manipulation of data

This is the building stage of development. The design is used to create the intended solution. Depending on the solution being created, the manipulation stage should involve:

- Creating programs using a programming language coding, validating, testing and adding internal documentation.
- Creating database using tables, relationships, forms, queries, reports and macros.
- Creating and formatting website using text, images, sound and hyperlinks.

Validation

Validation checks that the data being entered is reasonable. Validation can be either:

- Manual: conducted by the person inputting data into the system. This could be proofreading and/or reasonableness checks.
- Electronic: built into the system so that it is automatically checked. This includes data type, range check and existence checks.

Testing

Testing checks whether the solution does what it intends to do. This should be done while each part of the solution is being created as well as once the entire solution has been created and is working as a whole. This is done via a test table and a trace table.

Testing involves:

- Determining what needs to be tested.
- Determining what test data needs to be used for the tests.
- Determining the results that are expected for each test.
- Conducting the tests.
- Noting the actual results that occur.
- Fixing any errors that have been identified when the actual results differ from the expected results .

Documentation

Documenting involves creating meaningful internalt documentation for the program created.

Review Questions

6. Which part of the development stage involves checking the data that is entered into the system?
   A. Manipulation
   B. Validation
   C. Testing
   D. Documentation

7. In the testing phase of development, how can the tester tell that a fix is required?
   A. There is no test data
   B. Expected results and actual results are the same
   C. Expected results and actual results are different
   D. All tests are run successfully

Evaluation

As it appears in Units 1-4

This stage involves determining how successful the project was. It is usually conducted 6-12 months after implementation so that the users have had a chance to use the new system. Evaluation criteria should be established in order to determine whether the solution has solved the original problem. This stage also helps the project team to learn from any issues that occurred during the project so that they do not repeat these errors in future projects.

Determining a strategy

A strategy is needed to help find out whether the solution meets the requirements of the solution and whether the information problem was solved. This involves:

- Creating a timeline.
- Determining the data that will need to be collected.
- Determining the methods that will be used to collect the data.
- Relating data to the evaluation criteria that was created in the design stage.

Reporting

This involves assessing and documenting the extent to which the solution meets the user requirements. It reports what worked well and the requirements that were not met. Ultimately, this involves reporting whether the information problem was solved.

Review Questions

8. When should the evaluation occur?
    A. Before the information problem is noticed
    B. During the design stage
    C. When the solution is implemented
    D. After the solution has been used for a period of time

9. What is the purpose of evaluation?
    A. Determine whether the information problem was resolved
    B. Determine the cause of the information problem
    C. Determine the data that will need to be collected
    D. Determine who the users of the system are

Solutions to Review Questions

1. The correct answer is: B

   The reason for this problem is not wasting time, effort or money (A), it is not because of equipment failure (C) and orientation (D) is a design element, not a reason information problems occur. Data about the customers must be incorrect (B).

2. The correct answer is: C

   Functional requirements focus on what the solution needs to do (C). The other options refer to non functional requirements: user friendly (A), maintainability (B) and reliability (D).

3. The correct answer is: D

   Constraints are the conditions to be considered when creating the solution. The constraints that are listed refer to cost (A), level of expertise (B) and availability of equipment (C). D is something that needs to be taken into account during the project, however, it does not place a restriction as to the solution that is being developed.

4. The correct answer is: A

   A rectangle represents a process, which rules out options B and D. A diamond represents a decision, which rules out C and D. The only valid answer is A.

5. The correct answer is: B

   Pseudocode is written independent of the programming language. It shows the process the program will follow without having to consider the syntax of the language that will be used to develop the program.

6. The correct answer is: B

   Validation focuses on the reasonableness of the data while testing focuses on whether the system itself is working as it should.

7. The correct answer is: C

   If the actual results are different from the expected results, then the system must not be working the way it is intended, therefore a change needs to be made.

8. The correct answer is: D

Obviously, evaluation cannot occur before the problem is noticed (A). In the design stage (B) the criteria is determined, but the solution isn't actually evaluated at this time. If evaluation is to occur when the system is implemented (C), it will not give a full picture regarding whether the problem has been solved. Evaluating after the system has been used for a while will help ensure that all aspects of the system have been used, which will help determine if it meets the required needs.

9. The correct answer is: A

Evaluation is required to help determine whether the information problem has been solved (A). The cause of the information problem (B) and the users of the system (D) should be established in the analysis stage. The data to be collected (C) is a strategy used in the evaluation stage.