



STUDY GUIDE

FACULTY OF SCIENCE AND TECHNOLOGY

CBCH4103 **Human Computer Interaction**



FACULTY OF SCIENCE AND TECHNOLOGY

STUDY GUIDE

CBCH4103 Human Computer Interaction

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INTRODUCTION TO STUDY GUIDE

This Study Guide is intended for Open University Malaysia's **CBCH4103 Human Computer Interaction** course. It comes in TWO parts, as described below:

Part One comprises the Course Introduction, which gives you an overview of the course. More specifically, it provides you with the course synopsis, objectives, learning outcomes and study load. There is a brief description of the main textbook(s), which you must read to fulfil the course requirements. There is also a list of additional reading references. You are encouraged to go into myINSPIRE to check out the assessment, assignment and final examination formats.

Part Two comprises the Learning Guide. This starts with an overview, a recommended weekly study schedule to guide your learning process, and a brief description of the various elements in the Learning Guide. There is also a list of topics to be covered. For each topic, you are given the specific learning outcomes, a topic overview and a listing of the focus areas, together with assigned readings and the pages where information on the focus areas is found. To consolidate your learning and test your understanding, a summary of the main content covered and study questions are provided at the end of each topic.

Finally, there are two appendices, Learning Support and Study Tips, to help you walk through the course successfully.

Please read through this Study Guide before you commence your course. We wish you a pleasant study experience.

Contents

Part One: Course Introduction	5
Synopsis	5
Objectives	5
Learning Outcomes	6
Study Load.....	6
Main Textbook	7
Additional Recommended Readings	7
Assessment	7
Part Two: Learning Guide.....	9
Overview.....	9
Topic 1: Concepts of Interaction Design	11
Topic 2: Understanding Users	24
Topic 3: Designing for Collaboration and Communication.....	33
Topic 4: Affective Aspects	38
Topic 5: Interfaces and Interaction	44
Topic 6: Data Gathering, Analysis, Interpretation and Presentation ...	54
Topic 7: The Process of Interaction Design	67
Topic 8: Identifying Needs and Establishing Requirements	77
Topic 9: Design, Prototyping and Construction	83
Topic 10: Evaluation	87
Appendices	97
Appendix A: Learning Support.....	97
Appendix B: Study Tips	97

PART ONE: COURSE INTRODUCTION

Synopsis

This course is designed for Interaction Designers, who plan to venture into designing software interface for interactive products. The topics in this study guide cover the needs for a complete cycle of an iterative process from understanding users and requirements to the various types and techniques of evaluation. Some practical tips and concepts for usability and user experience goals are addressed. Leaders can read the contents in this study guide one topic per week, or read all the topics at once, then repeat them every week. They will find that the topics are coherent; one supports another, and content progresses from easy to complex. It is not necessary for learners to read from topic one to ten in sequence; they can read the topics depending on their preference as then they will be able to connect the content without any difficulty. Besides reading this study guide, learners are recommended to design appropriate interactive products to further their understanding. Referencing the discussions in the textbook and from the Internet will hone their understanding further and make them more immersed into designing the interaction.

Objectives

The general aims of this course are to:

1. Equip learners with understanding interaction design and the underlying concepts and theories of designing interactive products;
2. Expose learners to issues confronting the design and development of interactive products; and
3. Introduce learners to the various aspects to be considered in ensuring interactive products are usable for the intended users.

Learning Outcomes

By the completion of this course, you should be able to:

1. Explain the concepts of interaction design;
2. Discuss the importance of understanding users and context of use in designing and developing interactive products;
3. Design prototypes of interactive products by incorporating appropriate design principles; and
4. Evaluate interactive products to ensure that they are suitable for the intended users.

Study Load

It is a standard OUM practice that learners accumulate 40 study hours for every credit hour. As such, for a three-credit hour course, you are expected to spend at least 120 hours of learning. Table 1 gives an estimation of how the 120 hours can be accumulated.

Table 1: Allocation of Study Hours

Activities	No. of Hours
Reading course materials and completing exercises	60
Attending 4 tutorial sessions (2 hours for each session)*	8
Engaging in online discussions	17
Completing assignment(s)	20
Revision	15
Total	120

* Unless otherwise specified

Main Textbook(s)

Sharp, H., Yvonne, R., & Jenny, P. (2007). *Interaction design: Beyond human-computer interaction* (2nd ed.). West Sussex, England: John Wiley & Sons Ltd.

Additional Recommended Readings

- Ariffin, A. M. (2012). Incorporating multiple intelligence into electronic teaching materials in supports of usability aspect. In *Proceedings of 6th Knowledge Management International Conference 2012 (KMICE2012)*, 160-165.
- Ariffin, A. M., & Cut, N. A. (2012). Socio-pleasure in digital storybook. In *Proceedings of 6th Knowledge Management International Conference 2012 (KMICE2012)*, 203-208.
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- Mayhew, D. J. (1999). *The usability engineering lifecycle*. San Francisco, CA: Morgan Kaufmann.
- Nielson, J. (1994). Heuristic evaluation. In J. Nielson and R.L. Mack (eds). *Usability inspection methods*. New York: Wiley.
- Norida, M. D., Nur, T. A., & Ariffin, A. M. (2012). iMSL: Malay sign language for the deaf and hearing-impaired. In *Proceedings of 6th Knowledge Management International Conference 2012 (KMICE2012)*, 659-663.
- Nurulnadwan, A., Nur, H. M. R., & Ariffin, A. M. (2011). Visually-impaired children's acceptances on assistive courseware. *American Journal of Applied Sciences*, 8(10). 1019-1026.
- Schneiderman, B. (1998). Designing the user interface. *Strategies for effective human-computer interaction* (3rd ed.). Reading, MA: Addison-Wesley.
- Wickens, C. D., Gordon, S. E., & Liu, Y. (1998). *An introduction to human factors engineering*. Reading, MA: Addison-Wesley
- Zatul, A. S., Nurulnadwan, A., Ariffin, A. M., & Mohd, S. J. (2011). Assistive Courseware for Hearing-impaired Learners in Malaysia based on Theory of Multiple Intelligence (MI). *International Journal of Computer Sciences and Emerging Technologies*, 2(6), 370-377.

Assessment

Please refer to myINSPIRE for information on the assessment format and requirements.

PART TWO: LEARNING GUIDE

Overview

This Learning Guide is arranged by topic. It covers essential content in the main textbook and is organised to stretch over TEN study weeks, before the examination period begins. Use this Learning Guide to plan your engagement with the course content. You may follow the recommended weekly study schedule in Table 2 to help you progress in a linear fashion, starting with Week 1.

Table 2: Recommended Weekly Study Schedule

Topic	Week
Topic 1: Concepts of Interaction Design	1
Topic 2: Understanding Users	2
Topic 3: Designing for Collaboration and Communication	3
Topic 4: Affective Aspects	4
Topic 5: Interfaces and Interaction	5
Topic 6: Data Gathering, Analysis, Interpretation and Presentation	6
Topic 7: The Process of Interaction Design	7
Topic 8: Identifying Needs and Establishing Requirements	8
Topic 9: Design, Prototyping and Construction	9
Topic 10: Evaluation	10

Each topic in the Learning Guide comprises the following sections (refer to Figure 1):

- Learning Outcomes: Outline the specific tasks to be accomplished;
- Topic Overview: Briefly explains what the topic touches on so as to provide a general interpretative framework for understanding the topic content;
- Focus Areas: Identify the main and sub areas to be covered;

- Assigned Readings: Help you to navigate the main textbook and reading materials;
- Content Summary: Provides an interpretative framework for understanding the core content; and
- Study Questions: Help you to focus on key subject areas.

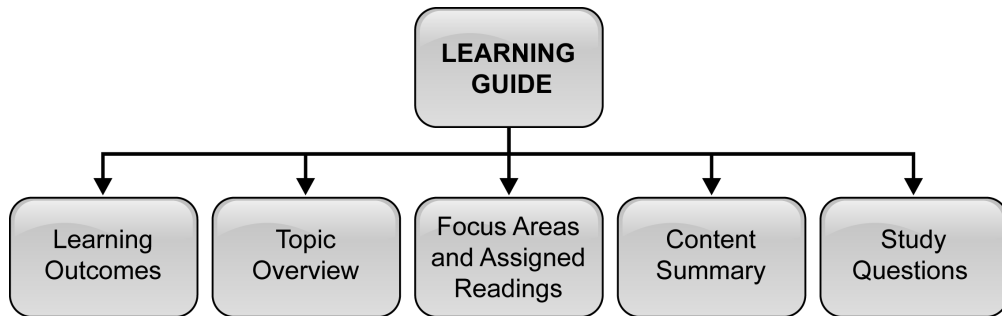


Figure 1: Organisation of the learning guide

Topic 1: Concepts of Interaction Design

Learning Outcomes

By the end of this topic, you should be able to:

1. Differentiate good and poor interaction design;
2. Describe the concepts of interaction design, user experience and usability;
3. Identify what and who is involved in the process of interaction design;
4. Explain the problem space and the process of conceptualising interaction;
5. Discuss conceptual models and metaphors and their respective roles;
6. Outline the core interaction types for informing the development of a conceptual model; and
7. Apply theories, models and frameworks as a way of informing interaction design.

Topic Overview

This topic explains the general concepts of interaction design. It establishes the concepts which will be further discussed in remaining topics. Usability and user experience goals, which stand as two aspects to be addressed in interactive products are discussed as well. They are coupled with a guide on understanding the need for studying the factors leading (the problem) to the solution. In addition to these, certain theories, models and frameworks are outlined in this topic to strengthen the foundation of interaction design.

Focus Areas and Assigned Readings

Focus Areas	Assigned Readings
1.1 What is Interaction Design? 1.2 The User Experience 1.3 The Process of Interaction Design 1.4 Interaction Design and the User Experience 1.5 Understanding the Problem Space 1.6 Conceptualising the Design Space 1.7 Theories, Models and Frameworks	Sharp, H., Yvonne, R., & Jenny, P. (2007). <i>Interaction design: Beyond human-computer interaction</i> (2nd ed.). West Sussex, England: John Wiley & Sons Ltd. <i>Chapter 1, pp 1 - 15.</i> <i>Chapter 1, pp 15 – 17.</i> <i>Chapter 1, pp 17 – 20.</i> <i>Chapter 1, pp 20–37.</i> <i>Chapter 2, pp 46–51.</i> <i>Chapter 2, pp 51–84.</i> <i>Chapter 2, pp 84–87.</i> Additional Recommended Readings Schneiderman, B. (1998). <i>Designing the user interface. Strategies for effective human-computer interaction</i> (3rd ed.). Reading, M.A.: Addison-Wesley. Wickens, C. D., Gordon, S. E., & Liu, Y. (1998). <i>An introduction to human factors engineering</i>. Reading, M.A.: Addison-Wesley.

Content Summary

1.1 What is interaction design?

- (a) The way products are designed to support users' needs. It leads to user experiences, which can enhance the way people work, communicate and interact.
- (b) It should make interactive products easy, efficient and engaging for users.
- (c) It concerns the front part of interactive products, while the functions are cared for by software engineers. As an analogy, interaction designers can be thought of as architects for a building.
- (d) It is the foundation for various fields that are concerned with developing interactive products, regardless of the domains (healthcare, education, entertainment, communication, etc.).
- (e) Aspects include terminology, navigation, content, layout and structure and have to be designed by incorporating design principles.
- (f) Design MUST be tailored for the target users.
- (g) An interaction design team should consist of various skills (content expert, programmer, writers, design specialist, etc.) so that ideas are wide and varied.

1.2 The user experience:

- (a) Focuses on how products behave and are used by people.
- (b) Designers have to design products to make them easy to use and to satisfy users' desires.
- (c) "Design for user experience".

1.3 The process of interaction design:

- (a) It involves four basic steps (see Figure 1.1):

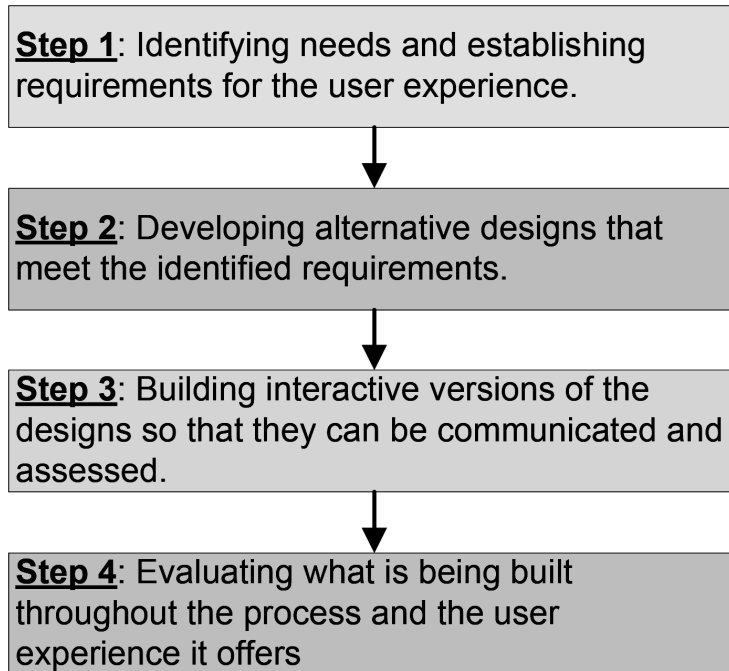


Figure 1.1: The process of interaction design

- (b) The processes have to be repeated as this ensures the designs are made better in every forthcoming cycle.
- (c) It needs to involve users in the processes.
- (d) Evaluation is the heart of interaction design: Aimed at making products usable – it is done through a User-centred Design (UCD) approach.
- (e) There are many techniques to involve users: observing them, talking to them, interviewing them, testing their performance, via a questionnaire or letting them co-design.
- (f) It is very important also to understand what the users do. Your design must be specific to the target users in mind. With that, you have to understand their task, their behaviour and the context of use (where, when, how, how long, etc).

- (g) When the design is tailored for the target users, their requirements will be fulfilled and this consequently reduces user frustration.
- (h) Users are not similar, they consist of children, adults, male and female, rural and urban areas; professional and physical workers; computer-literate and non-literate; nurses and teachers and many others. This is an indication that different users will require varying designs.

1.4 Interaction design and user experience:

- (a) Understanding users is important to ensure designs are efficient, allowing the users to be productive at work.
- (b) For that, goals must be in place and these goals can be classified into usability goals and user experience goals. They have different aims but both are important.

1.4.1 Usability Goals

- (a) Are concerned with meeting specific usability criteria.
- (b) Ensure the products are usable for the intended users.
- (c) Illustrate how usable the product is from usability perspectives.
- (d) Can be broken down into six more specific goals (see Figure 1.2):

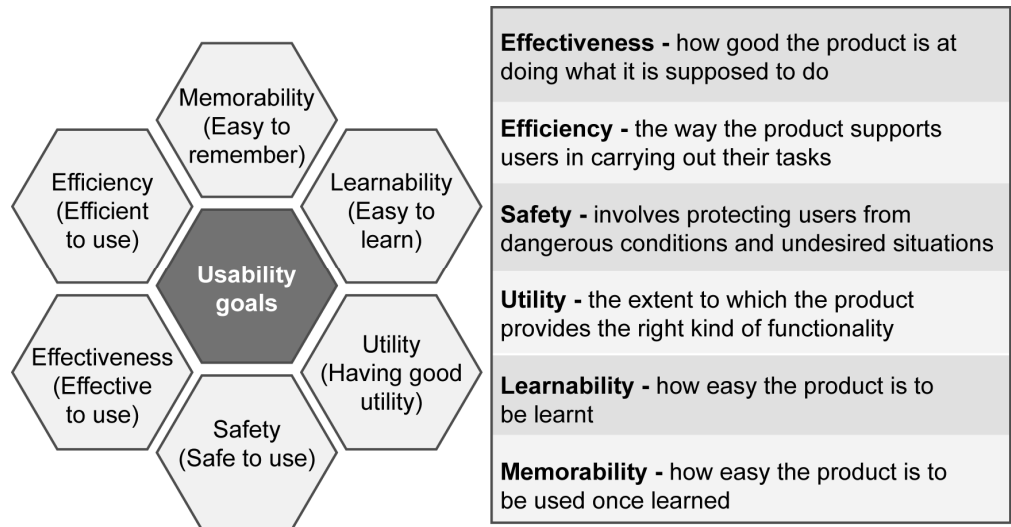


Figure 1.2: Usability goals

- (e) Asking about the six goals aids designers in being sure of their designs and in clarifying the problems and conflicts early on in the design process.
- (f) However, asking “is it easy to learn the system?” will not provide an actual picture of the situation. Rather, asking more detailed questions that lead to the goals will be more useful and of greater help. It should be very specific to the product being developed.
- (g) Understanding usability goals is a **MUST** in learning interaction design. The Internet provides a wealth of examples and discussions on this.

1.4.2 User Experience Goals:

- (a) Are concerned with making designs beyond being usable, to make them aesthetic as well.
- (b) Some user experience goals are as shown in Figure 1.3:

Satisfying	Helpful	Rewarding	Frustrating
Enjoyable	Motivating	Fun	Annoying
Pleasurable	Aesthetic	Provocative	Boring
Exciting	Pleasing	Surprising	Enhancing sociability
Entertaining	Surprising	Challenging	
Supporting creativity		Emotionally fulfilling	

Figure 1.3: User Experience goals

- (c) They are mostly subjective – providing illustrations to how users feel from their perspective.
- (d) Figure 1.3 combines positives and negatives, implying that there are certain user experience goals that are high and certain goals that are low.
- (e) While some can complement usability goals, some cannot (such as safety and fun).

1.4.3 Design Principles:

- (a) Design principles are used by designers to aid them in designing for user experiences.
- (b) Design principles are derived from a mix of theory-based knowledge, experience and common sense.
- (c) The principles do not intend to specify how to design an actual interface but aim to trigger ideas or notions that designers can incorporate into their designs.
- (d) Design principles are to be used in general, in the status of tasks, content, functions and other aspects.
- (e) A number of famous design principles are shown in Figure 1.4.

Visibility
Feedback
Constraints
Consistency
Affordance

Figure 1.4: Famous design principles

- (i) **Visibility** – think of the visibility versus invisibility of switches, knobs, controls, buttons, gears, clutch and the like.
- (ii) **Feedback** – think of the available and unavailable feedback of printing, installing, e-mailing and the like. They could be in the form of audio, text, visual or vibration.
- (iii) **Constraints** – used to prevent users from selecting inappropriate options. In Graphical User Interface (such as in MS Office), they hide the options by dimming the item.
- (iv) **Consistency** – products of a similar brand make use of similar interaction styles and pages of a system use similar styles (all Microsoft software use similar conventions).
- (v) **Affordance** – the system is ergonomic to support user tasks and in informing how they are to be used. This could be physical (like a curved chair back, keys or keyboard) and cognitive (like blinking buttons when a mouse rolls over). Affordance is an important topic of discussion. You can find out more by visiting asktog.com and useit.com sites.

1.5 Understanding the problem space:

- (a) Understanding the problem is the most important part in designing. Without the problem, designing cannot commence.
- (b) It is a team task, involving various experts in the team. They work together, using various techniques to understand the limitations in the study of space.

- (c) What is problem space? – It is the opportunity to design. It can be in the form of improving the existing design or designing a new product.
- (i) In the existing design – focuses on what can be made better in supporting users' tasks to make them more productive.
 - (ii) In the new product – focuses on the requirement that can make the product usable for users, and the requirement that supports their interest.
 - (iii) It has to be highly related to usability and user experience goals (see Figure 1.5).

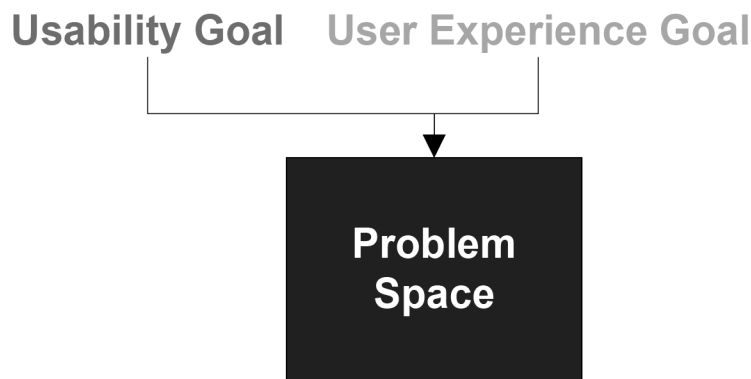


Figure 1.5: Problem space

- (d) Assumptions and claims are also very important in articulating the problem space.

1.6 Conceptualising the design space:

1.6.1 Having understood the problem space, the team can now progress to conceptualising it. This involves explaining the possible solution to the identified problem. In other words, it explains what the product or solution is, or what should be added to the system. Besides conceptual models, metaphors and interaction types, theories, models and frameworks can also be used whenever necessary.

1.6.2 Conceptual Model:

- (a) This is one of the most fundamental parts of interaction design. It explains how a product performs its tasks at a high level.

- (b) It is an abstraction that outlines what users can do with the product and what concepts are needed to understand how to interact with the product.
- (c) It is not a description of the user interface, but a structure outlining the concepts and the relationships between them that will form the basis of the product (or system).
- (d) The following are components of a conceptual model (see Figure 1.6):

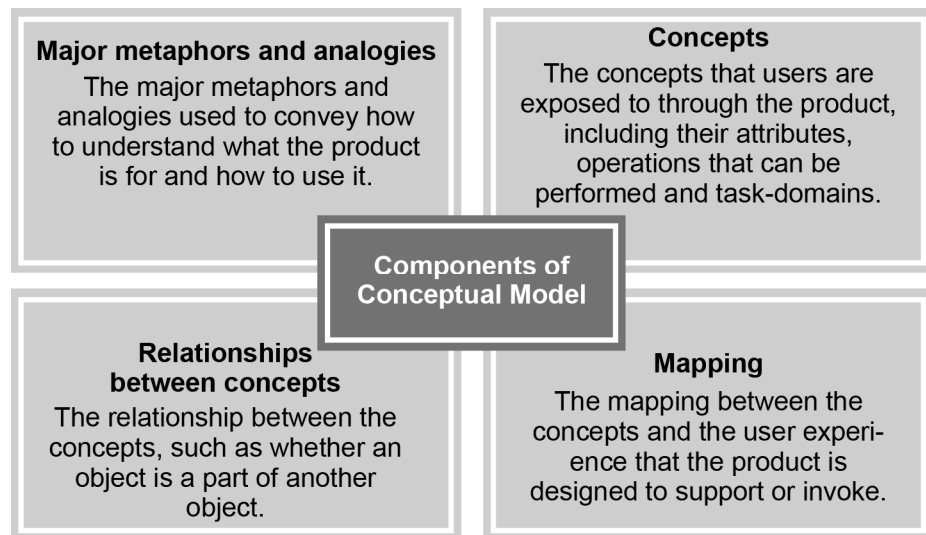


Figure 1.6: Components of a conceptual model

- (e) It takes a sufficient amount of time to decide on a conceptual model. The team has to debate on their ideas to determine the major metaphors and analogies, the concepts, the relationships between the concepts and the mappings.
- (f) Once the conceptual model is formulated and agreed upon, it will be the blueprint for the interaction design project.

1.6.3 Interface Metaphor and Analogies

- (a) Refers to the use of objects in the real world in the interaction design of products. It is important in supporting usability goals as well as user experience goals of products.

- (b) Metaphors can be in the form of visual representations, audio representations and other types of representations.
- (c) Also, it aids in the functionality, sequence of steps and mode of interaction with the product.
- (d) For example, learning materials often use classrooms as their metaphors and online shopping websites allow consumers to collect items into a cart first before proceeding to the cashier.
- (e) The selection of metaphors should be made critically, involving mapping with the preferences of the target users.

1.6.4 Interaction Types

There are four (even more) famous types of interaction that users can be provided with in the designed products; instructing, conversing, manipulating and exploring.

- (a) **Instructing** – where users issue instructions to the product/system. This can be done through typing in commands, selecting from menus in a window environment or on a touch screen, speaking aloud a command, pressing buttons, or using a combination of function keys;
- (b) **Conversing** – where users have a dialogue with the system. The users speak via an interface or type in questions to which the system replies via audio or text output;
- (c) **Manipulating** – where users interact with objects in virtual or physical space by manipulating them such as holding, opening, closing, etc; and
- (d) **Exploring** – where users move through a virtual environment or a physical space. Virtual environments include 3D and virtual reality systems.

Different types are suitable and appropriately used in certain contexts, in which other types are not. This has to be understood well when forming the conceptual model.

Table 1.1: Interaction styles

Factor	Instructing	Conversing	Manipulating	Exploring
Advantage	Interactions are quick and efficient	System can get rich input from the users and vice versa. Some systems can understand natural language	The results of users' actions are seen in real time. This enhances creativity and pleasure	Users can experience real things virtually
When is it suitable?	Repetitive tasks	In situations that need clarification	In designing works	To allow users to experience certain situations
Example	Vending machine	Advisory system	Moving objects and changing colours	Virtual house

1.7 Theories, models and frameworks

- (a) Interaction designs can also be inspired by theories, models and frameworks.
 - (i) **A theory** – is a well-substantiated explanation of some aspects of a phenomenon (such as the theory of information processing);
 - (ii) **A model** – is a simplification of some aspects of human-computer interaction intended to make it easier for designers to predict and evaluate alternative designs; and
 - (iii) **A framework** – is a set of interrelated concepts and/or a set of specific questions that is intended to inform a particular domain area (such as collaborative learning).
- (b) There are a lot of theories, models and frameworks in various domains. Accordingly, designers need to understand them to incorporate them into their product or system that is being designed.
- (c) They can also be combined together when the sounds of complementary is nice and supporting users' needs.
- (d) The use of theories, models, and frameworks in the design must not go against the usability and user experience goals of the product/system.

Study Questions

1. What is user interface?
2. What is interaction design?
3. Describe the interaction design steps.
4. Define “usability goals” and explain each one in greater detail.
5. Define “user experience goals” and each one in greater detail.
6. Why is establishing the problem space important?
7. What is a conceptual model?
8. What are the different types of interaction in designing?
9. Describe the roles of theories, models and frameworks in designing.

Topic 2: Understanding Users

Learning Outcomes

By the end of this topic, you should be able to:

1. Explain cognition including why it is important for interaction design;
2. Describe the main ways cognition has been applied to interaction design;
3. Provide a number of examples in which cognitive research has led to the design of more effective interactive products;
4. Explain mental models; and
5. Identify conceptual frameworks that are useful for interaction design.

Topic Overview

This topic focuses on cognition, which is a key ingredient in understanding users. “Users” is the main entity to be focused on while designing interactive products. Without understanding users comprehensively, designing works tend to be difficult and the products hardly support what users expect, especially in making their tasks easier to perform. The techniques that can be used to understand users are outlined in this topic, from which designers can select based on the context of needs.

Focus Areas and Assigned Readings

Focus Areas	Assigned Readings
2.1 What is Cognition? 2.2 Cognitive Frameworks	Sharp, H., Yvonne, R., & Jenny, P. (2007). <i>Interaction design: Beyond human-computer interaction</i> (2nd ed.). West Sussex, England: John Wiley & Sons Ltd. <i>Chapter 3, pp 94 - 116.</i> <i>Chapter 3, pp 116 - 132.</i> Additional Recommended Readings Mayhew, D. J. (1992). <i>Principles and guidelines in software user interface design</i>. Englewood Cliffs, NJ: Prentice Hall.

Content Summary

2.1 What is cognition?

- (a) Cognition is what goes on in a human's mind when carrying out tasks. It involves cognitive processes such as thinking, remembering, learning, daydreaming, decision-making, seeing, reading, writing and talking.
- (b) Cognition has also been described in terms of specific kinds of processes, including:
 - (i) **Attention** – the process of selecting things to concentrate on. It can either be through auditory or visual. It depends on two factors; goals and information presentation.
 - Goals – if the goals are exact and clear, actions will be effectively driven.
 - Information presentation – the way the information is displayed. This has to be appropriate keeping in mind the target users and context of use. If the information presentation can be flexible to support different needs, it is even better.
 - Design implications of attention are shown in Figure 2.1:

Attention

Make information salient when necessary.

Use techniques like animated graphics, colour, underlining, ordering of items, sequencing of different information and spacing of items.

Avoid cluttering the interface with too much information.

Use simple form-fill and search engine (if applicable).

Figure 2.1: Design implication of attention

- (ii) **Perception and recognition** – perception refers to how information is acquired from the environment, via different senses (ears, eyes and fingers) and transformed into experiences of objects, events, sounds and tastes.
- Various media elements can be used to support recognition.
 - For the use of various media elements, they have to be well-coordinated in ensuring logical representation.
 - Design implications of perception are shown in Figure 2.2:

Perception and recognition

Icons and other graphical representations should enable users to readily distinguish their meaning

Bordering and spacing are effective visual ways of grouping information in perceiving and locating items.

Figure 2.2: Design implications of perception

- (iii) **Memory** – involves recalling various kinds of knowledge that allow users to act appropriately. With memory we can recognise things, remember things that happened in the past and remember someone we have met. Without memory, we will not be able to function.
- Not all information needs to be remembered. Basically, information being attended to more extensively will be remembered better than those not attended to.
 - Hence, information needs to be represented in a way that supports memory.
 - Recognition is always better than recall.
 - Recognition – to recognise things at first sight.

- Recall – recognise things after putting effort to join registered information.
- Designing things visually to support recognition – the use of metaphors are very meaningful.
- When users recognise, without having to recall, it avoids memory load.
- Memory load – occurs when we have to put in effort for some information, such as recalling addresses. The objective in design is to reduce memory load as much as possible.
- Design implications of memory are shown in Figure 2.3:

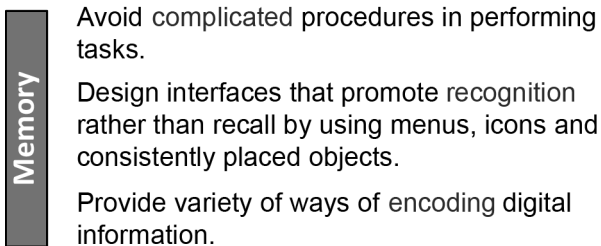


Figure 2.3: Design implications of memory

- (iv) **Learning** – occurs when (1) learning to use computer applications and (2) using a computer-based application to understand a given topic.
- People learn more through doing, not by reading manuals:
 - Hence GUI and direct manipulations are very helpful.
 - Utilising constraints (discussed in Topic 1) can help beginners.
 - Information architecture – good to form a simple-to-complex or shallow-to-deep ascending flow of order.
 - Also provides a non-hierarchical way of interacting with the contents interactively.
 - Interactivity is very important to make user interaction with the contents dynamic.
 - Remember: incorporate design principles to support usability goals and user experience goals (discussed in

Topic 1) while designing the layout, content, structure and navigation for interactivity.

- Design implications of learning are shown in Figure 2.4:

Learning

Design interfaces that encourage exploration.

Design interfaces that constrain and guide users to select appropriate actions when initially learning.

Dynamically link concrete representations and abstract concepts to facilitate the learning of complex materials.

Figure 2.4: Design implications of learning

- (v) **Reading, speaking and listening** – they bring similar meaning to the message, but the ease of grabbing the meaning is different. It depends on the people, tasks and context. Studies have proven that listening is easier than reading and the learning rate for different channels of information grabbing is different (from listening to learning by doing or teaching).
- There are possibilities to combine various modalities to support information grabbing. Some of these are in the form of:
 - Animation;
 - Video;
 - Simulation;
 - Speech-output and speech recognition;
 - Interactive digital books;
 - Cognitive aids; and
 - Assistive applications.
 - These then have to be linked with the appropriate interaction style (discussed in Topic 1).
 - Design implications of reading, speaking and listening are as follows (see Figure 2.5):

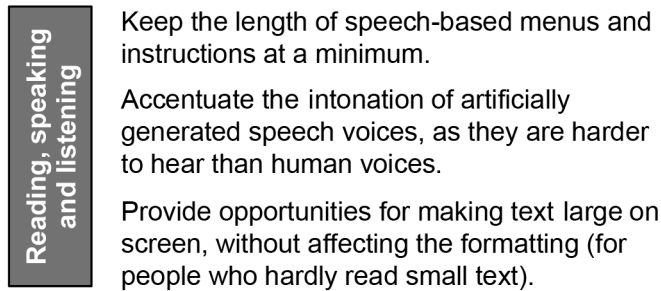


Figure 2.5: Design implications of reading, speaking and listening

- (vi) Problem-solving, planning, reasoning and decision-making are all processes involving reflective cognition.
- Involves high level thinking such as: what to do, how to do, what the options are and the like.
 - The extent to which people are involved in reflective cognition depends on their level of experience with the domain, application, or skills (novice vs expert, experienced vs inexperience, beginner vs advanced).
 - Design implications of problem-solving, planning, reasoning and decision-making can be seen in Figure 2.6:

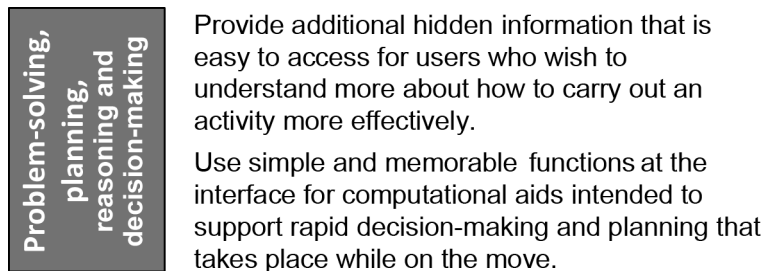


Figure 2.6: Design implications of problem-solving, planning, reasoning and decision-making

- (c) They are inter-dependent; where several may be involved in a single activity (rarely just one is used in isolation).

2.2 Cognitive Frameworks

Conceptual frameworks are developed to explain and predict user behaviour based on theories of cognition. Some of them are explained in the following:

(a) Mental model

- (i) Used by people to reason about a situation or system (to react in certain conditions).
- (ii) The more people learn about the system, the deeper and more transparent the mental model they develop.
 - Mechanics have a deep mental model of a car (to enable them to fix problems) compared to normal citizens (who drive the car).
- (iii) Designers have to support users in their design by understanding users' mental model.
- (iv) These are some guidelines:
 - Useful feedback in response to user input;
 - Easy-to-understand and intuitive ways of interacting;
 - Clear and easy-to-follow instructions;
 - Appropriate online help and tutorial (if applicable); and
 - Context-sensitive guidance for users, set at their level of experience, explaining how to proceed when they are not sure what to do.

(b) Theory of action

- (i) Specifies seven stages of activities:
 - Establish a goal;
 - Form an attention;
 - Specify an action sequence;
 - Execute an action;
 - Perceive the system state;
 - Interpret the state; and
 - Evaluate the system state with respect to the goals and attention.

- (ii) This requires designers to map their design elements with the users in mind. Some possible design elements include dialog box, menu and sequencing of items, cursor changing, visual cue, audio cue and many others.

(c) **Information processing**

- (i) Supports the use of metaphors and analogies (discussed in Topic 1).
- (ii) The human memory can be modelled as follows (see Figure 2.7):

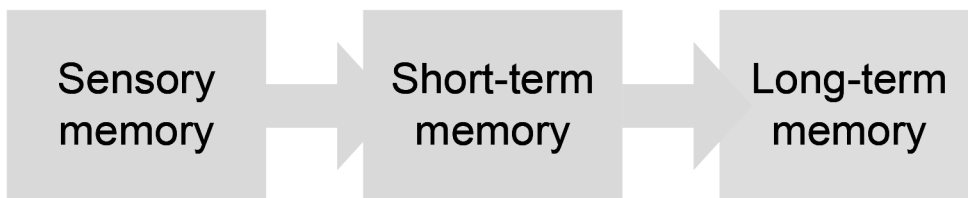


Figure 2.7: Model of human memory

- (iii) Everything seen will be processed in the sensory memory. Then, only information attended to will be stored in the short term memory, while the rest decay (lost). When the information in the short-term memory is processed, many times with full attention, it is further stored in the long-term memory.

(d) **External cognition**

- (i) Concerns with explaining the cognitive processes involved when interacting with different external representations. The main goal is to explicate the cognitive benefits of using different representations for different cognitive activities and the processes involved. The main ones include:
 - Externalising to reduce memory load – such as noting addresses in an address book – do not have to remember (now phone numbers are stored in our cell phones).
 - Computational offloading – such as using external tools for externalising (like using pen and paper in sketching a house design).

- Annotating and cognitive tracing – such as modifying representations through striking through, noting and underlining and externally manipulating items into different orders.

Study Questions

1. What is cognition?
2. Describe cognition in terms of specific kinds of processes.
3. Explain how understanding mental model and information processing help in designing.

Topic 3: Designing for Collaboration and Communication

Learning Outcomes

By the end of this topic, you should be able to:

1. Explain the concept of communication and collaboration;
2. Describe the social mechanisms that are used by people to communicate and collaborate;
3. Outline the range of collaborative systems that have been developed to support this kind of social behaviour; and
4. Describe some of the new forms of social behaviour that have emerged as a result of the advancement of technology.

Topic Overview

There are various types of interactive products, and collaboration and communication ones are among the very famous ones. Designing them to support usability and user experience goals is critical. Hence, this topic provides some practical tips to consider when providing such tools for society.

Focus Areas and Assigned Readings

Focus Areas	Assigned Readings
3.1 Social mechanism in communication and collaboration 3.2 Conversational Mechanism 3.3 Coordination Mechanism 3.4 Awareness mechanism 3.5 Technology-mediated social phenomena	Sharp, H., Yvonne, R., & Jenny, P. (2007). <i>Interaction design: Beyond human-computer interaction</i> (2nd ed.). West Sussex, England: John Wiley & Sons Ltd. <i>Chapter 4, pp 136 - 136.</i> <i>Chapter 4, pp 136 - 160.</i> <i>Chapter 4, pp 161 - 166.</i> <i>Chapter 4, pp 166 - 171.</i> <i>Chapter 4, pp 172 - 174.</i> Additional Recommended Readings Ariffin, A. M., & Noor, L H. (2011). Design and development of a ubiquitous cancer care system: A collaborative communication among cancer community. <i>Informatics Engineering and Information Science</i>, 254, 115-134.

Content Summary

3.1 Social mechanism in communication and collaboration

- (a) A fundamental aspect of life is being social, i.e. communicating with other people. Now, communication can be done virtually. Previously, communication was assisted with telephone and then telephones were enabled with text-based information transmission.
- (b) Now, phones are “everything” – allowing videos to be transmitted as well. This really supports communication and collaboration in creating social interaction.

- (c) We shall focus on three core forms of social mechanisms that are used and then illustrate how technological systems have been and can be designed to support them:
 - (i) The use of mechanisms in conversation to avoid conversational breakdown.
 - (ii) The use of coordination mechanisms to allow people to work and interact together.
 - (iii) The use of awareness mechanisms to find out what is happening, what others are doing and to let others know what is happening.

3.2 Conversational mechanism

- (a) Understand the nature of conversation – opening, content, towards the close and close.
- (b) More than one involved – there must be some mechanism for taking turns.
- (c) Types of conversations – argument, discussion, debate, chat, etc. – can be classified into formal and informal.
- (d) Designing collaborative technologies to support conversation:
 - (i) Designing for communicating in physically different locations – make users feel like they are conversing face-to-face with people at the opposite end.
 - “Whatsapp”, chatting in Facebook
 - (ii) Designing for communication in co-located settings – a few groups communicating from different locations.
 - Video conference
 - (iii) Designing for communication on computer-mediation – any communication using computers.
- (e) They need to be equipped with various tools and features (like emoticons, attachment, and formatting). This has to be tailored to the purpose, context of use and users. Remember, they must support usability and user experience goals.

3.3 Coordination mechanism

- (a) The nature of coordination – people interact with each other to achieve something.
- (b) In collaboration, people normally coordinate with each other.
- (c) To help the progress of coordination, these three coordinating mechanisms can be utilised:
 - (i) Verbal and non-verbal communication:
 - In formal coordination, always notes, memos and minutes are used to ensure the progress of coordination.
 - In informal coordination (like moving a drawer) – the words “left a bit”, “down a bit”, and the like are used.
 - Also, apparatus and gestures are used in situations where either voice or written messages are not possible (such as arms and baton in signalling for air planes to land).
 - In computer based coordination, these can be adapted into creating efficient metaphors.
 - (ii) Schedules, rules and conventions:
 - They are important in physical life and helpful also in computer-based coordination.
 - (iii) Shared external representations:
 - Many things can be done with shared representations, such as whiteboards, calendars and planners.
 - In computer-based coordination, they also have similar purposes.
- (d) Remember, design them to be suitable for the target user, purpose and context of use.

3.4 Awareness mechanism:

- (a) Awareness implies knowing who is around, what is happening and who is talking with whom.
- (b) Conversation and coordination are within awareness – are people aware of the collaboration going on? What indicates this? Are they aware of how many people are involved? Are they aware of what is next?

- (c) Designing this requires critical analysis of the user's needs to be matched with the purpose and context of use.

3.5 Technology-mediated social phenomena:

- (a) Technology has played its role excellently in allowing everyone to socialise no matter what the boundary is. The following are some examples:
 - (i) Do you realise that you have now reunited with your old friends?
 - (ii) People share their experiences.
 - (iii) People share knowledge via videos.
 - (iv) Students publicise their work to the world.
 - (v) Seminars are set-up virtually.
 - (vi) Degrees are obtained virtually.
 - (vii) Emotions are conveyed virtually.
 - (viii) Businesses are finished in a day.
 - (ix) Documents are transmitted cross-continent in a minute.

Study Questions

1. What are communication platforms for various users?
2. How should different communication purposes be addressed?
3. What are the differences in elements in different types of communication formats?

Topic 4: Affective Aspects

Learning Outcomes

By the end of this topic, you should be able to:

1. Explain what expressive interfaces are and the effects they can have on people;
2. Outline the nature of user frustration and how to reduce it;
3. Describe how technologies could be designed to change people's attitudes and behaviour;
4. Examine the pros and cons of applying anthropomorphism in interaction design; and
5. Describe the affective aspects used in interface agents.

Topic Overview

Among important aspects in advanced interactive products is affective ability, in which interactive products are able to understand human emotions and respond accordingly. The input and output forms are among its main concerns. Discussions in this topic enrich the recommendations in the previous topics.

Focus Areas and Assigned Readings

Focus Areas	Assigned Readings
	Sharp, H., Yvonne, R., & Jenny, P. (2007). <i>Interaction design: Beyond human-computer interaction</i> (2nd ed.). West Sussex, England: John Wiley & Sons Ltd.
4.1 What are Affective Aspects?	<i>Chapter 5, pp 180 - 182.</i>
4.2 Expressive Interfaces and Positive Emotions	<i>Chapter 5, pp 182 - 188.</i>
4.3 Frustrating Interfaces and Negative Emotions	<i>Chapter 5, pp 188 – 195.</i>
4.4 Persuasive Technologies	<i>Chapter 5, pp 195 – 199.</i>
4.5 Anthropomorphism in Interaction Design	<i>Chapter 5, pp 199 – 202.</i>
4.6 Models of Affective Aspects	<i>Chapter 5, pp 207 – 210.</i>

4.7 Technology as an Experience Framework	<i>Chapter 5, pp 210 – 213.</i> Additional Recommended Readings Ariffin, A. M., Adi, L. S., & Mohd, N. A. (2014). Arousing elements in children's digital interactive storybook. In <i>Proceedings of International Conference on Knowledge Management International Conference (KMICe 2014)</i>. Ariffin, A. M., & Yusuf, J. (2014). Interactive teaching materials for pre-schools: Some practical guidelines. In <i>Proceedings of International Conference on Knowledge Management International Conference (KMICe 2014)</i>. Ariffin, A. M., Nurulnadwan, A., & Zatul, A. S. (2011). Digital storytelling makes learning fun and entertaining. <i>International Journal of Computer Applications</i>, 18(1), 20-26. Ariffin, A. M., & Cut, N. A. (2012). Socio-pleasure in digital storybook. In <i>Proceedings of 6th Knowledge Management International Conference 2012 (KMICE2012)</i>, 203-208. Ariffin, A. M., Mohd, H. A. W., & Norshuhada, S. (2009). <i>Measures for Entertaining and Fun-Of-Use. MASAUM Journal of Survey and Reviews</i>, 1(1), 51 – 61. Malone, T. W. (1984). Heuristics for designing enjoyable user interfaces: Lessons from computer games. In Thomas, J.C. & Schneider, M.L. (Eds), <i>Human factors in computer systems</i>. Norwood, NJ: Ablex Publishing Corp.
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Content Summary

4.1 What are affective aspects?

- (a) Affective refers to emotional responses.
- (b) Computers are suggested to be affective – to recognise human emotion and to respond accordingly, as well as to be able to express their emotions with respect to the context.

4.2 Expressive interfaces and positive emotions:

- (a) Expressive interface – emoticons, sound, icons and virtual agents.
- (b) Used to:
 - (i) Convey emotional states – we are very familiar with the emoticons (such as in Whatsapp and Facebook chatting).
 - (ii) Elicit certain kinds of emotional responses in users (such as feeling at ease, comfort and happiness).
- (c) Designing the expressive interface must be supported with appropriate metaphors.
- (d) The expressive interface can also be used to inform about a certain status, such as:
 - (i) A folder expands when a file is loaded into it.
 - (ii) An audio cue appears when a file is closing.
- (e) Most of the times, expressive interfaces are really helpful, they are simple, but are able to convey the right meaning. More importantly, users type less to convey their emotions.

4.3 Frustrating interfaces and negative emotions:

- (a) When interfaces are not designed to meet users' needs, they may lead to negative emotions.
- (b) Users always feel bad when they perceive that the interface makes them look stupid, insulted or threatened.
- (c) Figure 4.1 shows the reasons that lead to negative emotions:

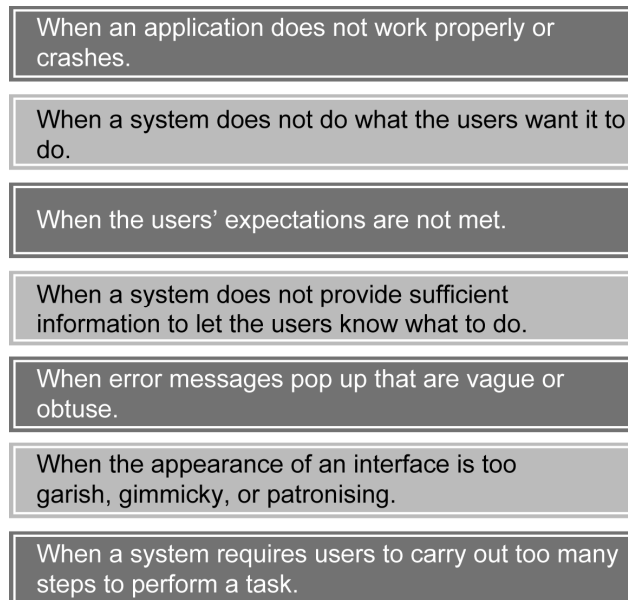


Figure 4.1: Reasons for negative emotions

- (d) Thus, designers have to really understand the users, and the context of use. Without understanding these, the possibility of frustrating users is high.
- (e) Compare your experience when dealing with cell phones three to five years ago with your current experience (with touch-enabled interface).
 - (i) How was it for connecting to the Internet?
 - (ii) How was it for “ON” the Bluetooth?
 - (iii) How was it to open an application?

4.4 Persuasive technologies:

- (a) Now, interactive applications are able to persuade users. This can be seen in applications that suggest users to purchase something based on currently selected items (mostly in e-commerce websites).
- (b) Persuasive design has also been used in safety, preventive healthcare, fitness, personal relationship and learning, in which the emphasis is on changing users' habits, or doing something that will improve their well-being.

- (c) It has certain principles that designers can incorporate into their design to make their applications persuasive in the aimed domain.
- (d) Nevertheless, the usability and user experience goals have to be adhered to because users attend to the fundamental aspects first before proceeding into the persuasive “room”.

4.5 Anthropomorphism in interaction design:

- (a) Anthropomorphism refers to the human intellect in applications. It is conveyed through certain agents in the forms of friends, teachers, trainers, doctors, parents, or whoever. Human characteristics are also embedded in toys. This is also called anthropomorphism.
- (b) Generally, a well-designed and appropriately serving anthropomorphism helps users.
- (c) However, there are many critics on anthropomorphism, that make designers unsure of its urgency and applicability.
- (d) Sometimes the anthropomorphism is too much, making users feel annoyed (such as when they appear without being expected), distracted, or disturbed.
- (e) The key here is anthropomorphism is not necessarily helpful, depending on whether it is really useful and designed to assist users when necessary.

4.6 Models of affective aspects:

- (a) Emotional design model
 - (i) Many studies have used this model to understand how users react to certain designs.
 - Visceral design – making products look, feel and sound good.
 - Behavioural design – focuses on use and equates this with the traditional values of usability.
 - Reflective design – taking into account the meaning and personal value of a product in a particular culture.

- (ii) Based on the earlier mentioned, understanding the users and the context of use are compulsory in designing an interface.
- (b) Pleasure models – models that urge that pleasure should be supported at different levels of experience (the body, the mind, the spirit, the idea and everything must be ensured to be entertained when dealing with interactive applications).
 - (i) Physio-pleasure – body.
 - (ii) Socio-pleasure – enjoyment in the company of others.
 - (iii) Psycho-pleasure – emotion and cognition.
 - (iv) Ideo-pleasure – people's value.

4.7 Technology as an experience framework:

Four core threads that make-up a holistic experience:

- (a) The sensual thread – is concerned with sensory engagement with a situation.
- (b) The emotional thread – such as sorrow, anger, joy and happiness.
- (c) The compositional thread – is concerned with the narrative part of an experience.
- (d) The spatio-temporal thread – refers to the space and time the experience takes place and their effects.

Study Questions

1. What are expressive interfaces?
2. What are factors of negative emotions towards a system?
3. Describe persuasive technology.
4. Discuss the impacts of anthropomorphism in a system.
5. Examine the pleasure model.

Topic 5: Interfaces and Interaction

Learning Outcomes

By the end of this topic, you should be able to:

1. Explain the notion of a paradigm and set the scene for how the various interfaces have developed in interaction design;
2. Describe different kinds of interfaces; and
3. Identify the best interface for certain conditions.

Topic Overview

This topic discusses various interface paradigms and types. Having discussed the concepts extensively in previous topics, this topic carries on with lighter discussion on what could be used in getting inputs and offering the outputs. Information display makes users feel attracted at the first sight; hence this topic takes that into the discussion as well.

There are various forms of interface elements that can be suitably utilised in different contexts. Designers have to carefully consider them when designing applications, systems, or products. Remember: the key in designing is to support usability and user experience goals. Hence, the designers have to clearly understand what makes users happy when using the system in the intended context.

Focus Areas and Assigned Readings

Focus Areas	Assigned Readings
5.1 Paradigms 5.2 Interface Types 5.3 Interfaces in the 1990s 5.4 Interfaces in the 2000s	Sharp, H., Yvonne, R., & Jenny, P. (2007). <i>Interaction design: Beyond human-computer interaction</i> (2nd ed.). West Sussex, England: John Wiley & Sons Ltd. <i>Chapter 6, pp 218 - 219.</i> <i>Chapter 6, pp 219 - 240.</i> <i>Chapter 6, pp 240 - 265.</i> <i>Chapter 6, pp 265 - 286.</i> Additional Recommended Readings Ariffin. A. M., Syarifah, N. S. Y., Sobihatun, N. A. S., Mazida, A., & Massudi, M. (2014). Assistive contents for hearing-impaired people. In <i>Proceedings of International Conference on Knowledge Management International Conference (KMICe 2014)</i>. Ariffin, A. M., Syarifah, N. S. Y., & Sobihatun, N. A. S. (2012). Learning object for the hearing-impaired: Design and development of KoswerPendidikan Islam Tunakerna (KOSPIT). In <i>Proceedings of International Conference on Knowledge Management International Conference (KMICe 2012)</i>. 251-155. Dix, A., Finlay, J., Abowd, G. D., & Beale, R. (2004). <i>Human-computer Interaction</i> (3rd ed.). London, UK: Pearson Education Limited.

Content Summary

5.1 Paradigm:

We have seen paradigm changes in computers over the years, including the following:

- (a) The evolution of input/output devices;
- (b) The evolution of physical form;
- (c) The evolution of command-based to windowing system;
- (d) The evolution of computing functions;
- (e) The evolution of anthropomorphism levels;
- (f) The evolution of pervasiveness and ubiquity of computing systems;
- (g) The expansion of computing users; and
- (h) The expansion of domains benefited by computing functions.

5.2 Interface types:

- (a) There are many kinds of interfaces that can be used to design for user experience. Remember: they have to be used suitably with the target users in mind and the context of use.
- (b) We can divide them into command-based and Graphical User Interface (GUI):
 - (i) Command:
 - Users have to type the command line (like with UNIX, DOS).
 - Has specific syntax, users have to memorise the syntax. When there is a small mistake, the computer system is unable to understand the command.
 - Experts can combine a few steps in a line, making their process fast and efficient.
 - Beginners always find difficulties in writing the command.

(ii) WIMP/GUI

- Visual-based interface (with colours, typography and imagery), such as using buttons, check-box, radio buttons and a pull-down menu. Users do not have to memorise any syntax.
- The original WIMP comprised:
 - Window – with scroll, stretch, overlap, open, close and move around functions. This includes dialogue boxes;
 - Icons – that provide certain functions like linking to something, opening certain windows and providing certain tools;
 - Menus – offering list of options; and
 - Pointing devices – mouse and touch screen.
- Evolution of WIMP – from boxy to different kinds of elements. Now we have audio menu, 3D-animated icons, 2D-based menus and audio icons. These allow designers to carefully design for user experience and to make applications be used at ease.
- The following is a more detailed explanation of the different components of WIMP:
 - **Windows** are always helpful. But, they need to be carefully designed to ensure that they do not distract the flow on users' part. Normally, too many window pop-ups can make users confused. Besides, they hide other information, putting excise on the users' part.
 - **Menu** design is also critical. It attracts users to click on the content. Besides being attractive, the menu should also help users in making their decision. Important characteristics of menus include:
 - (a) Menu items could be grouped into appropriate classes;
 - (b) Heading is necessary;
 - (c) Most recommended/frequent/liked is placed at the top, followed with the less recommended in descending order; and

- (d) The depth and breadth of the menu items should be carefully engineered. Not too long, and not too wide to support users in decision-making.
- Icons can be used very pervasively. Designing them needs critical understanding of the users and their background.
 - (a) The use of metaphors (introducing elements in the real world into the system – like a pair of scissors to mean ‘cut’) is very meaningful;
 - (b) Sometimes animated icons are workable; and
 - (c) Providing icons with tool-tip text is really informative for first time users of the icons.

5.3 Interfaces in the 1990s

(a) **Advanced graphical interfaces**

Multimedia – combines various media elements (text, images, graphics, audio, videos, animations and simulations).

- (i) They are interactive – allowing users to interact with the system.
- (ii) This can be seen in games, learning sciences (discovering the photosynthesis process for example), business simulations and in promotional advertisements.
- (iii) It provides better ways for representing information, supporting the philosophies of “more is more” and “the whole is better than a piece of the parts”.
- (iv) Furthermore, multimedia makes learning abstract things, such as the processes in the human body, more concrete.
- (v) In short, multimedia is always better than any single media for easier learning, better understanding, more engagement and more pleasure.
- (vi) Nevertheless, designers should make use of media elements wisely, never overloading the screen with unnecessary make-over. This has to be tailored suitably for the benefit of the target users, with respect to the context of use.

- (b) **Virtual environment** – refers to computer-generated graphical simulations.

It is intended to create an illusion of participation in a synthetic environment rather than external observation of such an environment.

- (i) There are different levels of virtual environment applications.
 - (ii) They provide new kinds of experiences. A deep virtual environment can make users really get into the environment, in which they feel they are really in “that world”. As an example, take-off and landing terrains developed for flight simulators can appear to be very realistic.
 - (iii) This has been widely used in education and training, as well as entertainment.
 - (iv) It is very effective in bringing the feel of presence among users while experiencing the created “world”.
- (c) **Visualisation** – used to present real time dynamic information to users. Colours and shapes are important elements.
- (i) In such applications, the shapes and their sizes evolve according to the changing information they represent, such as those in the market share.
 - (ii) The colours can also change to indicate certain meaning such as urgency or importance as well as represent certain levels.
 - (iii) This approach really informs users and proves to be an easy way to get information.
- Web-based interfaces:
 - There are usability guidelines for websites:
 - (a) Simplicity;
 - (b) Feedback;
 - (c) Speed;
 - (d) Legibility;
 - (e) Ease of use; and

(f) Downloading time.

- The guidelines gradually evolve, however never discarding anything good for the users.
 - Usability and user experience goals should be focused on.
 - The trade-offs between usability and attractiveness should be carefully considered.
- Speech interface:
 - The system speaks to the users, and users interact with the system using either a keypad or speech modes.
 - Often found in phone banking systems.
 - The systems understand human voice.
 - People with disabilities are able to deal with computing functions using speech interface.
 - Pen, gesture and touchscreen interfaces:
 - Pen-based – widely used in making 2D animations. Now, tablets are incorporated with pen-based input mechanisms, enabling tasks to be more interesting. Drawing is made easy and pointing is sharp.
 - Gesture – can be found in lighting, where sensors are used to control the lights ON/OFF. Games also utilise gesture for inputs. This makes interaction with the applications very straightforward, avoiding confusion.
 - Touchscreen – current applications make use of touchscreen very widely. In touchscreen, icons are highly necessary to simplify complex steps in a menu system, with pointing devices.
 - Appliance interfaces:

This is available in appliances in the house, office, public areas and in vehicles:

 - Vending machine;
 - Washing machine;
 - Remote controls;

- Photocopier;
- Printer; and
- Navigation system and etc.

5.4 Interfaces in the 2000s

- (a) Mobile interfaces – mobile devices make computing functions very pervasive. Now not only do people use mobile devices while on the move, they also use these anywhere, at any time.
 - (i) Besides checking stocks and entertainments, learning is also available on and assisted by mobile devices.
 - (ii) The screens are small, computing power is low, memory is low, the speed is slow and control space is limited – hence applications for mobile devices should support these limitations.
 - (iii) Think of suitable input styles for mobile interfaces. Currently we are using touchscreen very widely. What will be the most preferred style in three years? In five years? In seven years? Can you anticipate the evolution?
- (b) Multimodal interfaces – touch, sight, sound and speech – make the experience more varied.
 - (i) It supports more flexible, efficient and expressive means of human-computer interaction.
 - (ii) People with disabilities can take part in utilising computing functions.
 - (iii) The multi-modalities can be either in the input or the output.
- (c) Shareable interfaces – more than one person can use the interface at a time, in a collaborative environment. In an online environment, people from different locations can design a product in a shared canvas, in which one person can top-up additional compartments over the design made by another person in real time.
 - (i) Makes real-time conversation very meaningful;
 - (ii) Use of icons, buttons and other GUI is necessary; and
 - (iii) Audio is also necessary besides the visual.

- (d) Tangible interfaces—using real objects coupled with digital representation to interact with computers.
 - (i) Sensors are placed in the real objects that affect the digital representation.
 - (ii) Most famously used is RFID.
- (e) Augmented and mixed reality interfaces—augmented reality combines the real world with the digital world.
 - (i) The applications can be coupled with animations to explain certain processes to enhance the learning experience. Also, they could be coupled with respective information for tourists.
 - (ii) The inputs are through cameras or sensors, while the output could be in many forms.
- (f) Wearable interfaces – allows wearable items to have computing functions. They are always on and never consume users' attention physically or cognitively.
 - (i) When IPv6 is fully utilised, all electronic appliances could have their fixed IP address, enabling them to communicate with each other.
 - (ii) Not only that, earrings, necklaces, bracelets, tie pins and watches can also communicate now.
 - (iii) This wearable computing has been widely used in healthcare and military sectors.
- (g) Robotic interfaces – science fiction has demonstrated how robots could interact with humans.
 - (i) In industry, robots have been pervasively used.
 - (ii) At home, robots are utilised for sweeping the floor, tidying-up rooms and accompanying the elderly.

Study Questions

1. List and describe the paradigm changes in computers.
2. Discuss the various interaction tools that are available, with respect to various contexts.

Topic 6: Data Gathering, Analysis, Interpretation and Presentation

Learning Outcomes

By the end of this topic, you should be able to:

1. Discuss how to plan and run a successful data gathering programme;
2. Execute an interview, questionnaire and observation;
3. Explain the differences between qualitative and quantitative data and analysis;
4. Analyse qualitative and quantitative data; and
5. Identify the advantages and disadvantages of the different techniques

Topic Overview

This topic will cover the various techniques that can be used in gathering data. These techniques are affected by the key issues in data gathering, data recording and the methods and intent behind interviews, questionnaires and observations. It is also important to be equipped with the knowledge to be able to distinguish between qualitative and quantitative methods and the advantages and disadvantages of each one. The techniques for qualitative approach are not similar to the techniques for quantitative approach. This topic will also elaborate on these techniques, in respect to different context of needs.

Focus Areas and Assigned Readings

Focus Areas	Assigned Readings
6.1 Key Issues in Data Gathering 6.2 Data Recording 6.3 Interviews 6.4 Questionnaires 6.5 Observations 6.6 Data Analysis, Interpretation and Presentation	Sharp, H., Yvonne, R., & Jenny, P. (2007). <i>Interaction design: Beyond human-computer interaction</i> (2nd ed.). West Sussex, England: John Wiley & Sons Ltd. Chapter 7, pp 292 - 294. Chapter 7, pp 294 - 298. Chapter 7, pp 298 - 308. Chapter 7, pp 308 - 321. Chapter 7, pp 321 - 342. Chapter 8, pp 355 - 386. Additional Recommended Readings Ariffin, A. M., Wong, Y. K., & Mohd, H. A. W. (2011). Using digital storytelling to determine good and bad features for use in learning materials. In <i>Proceedings of 10th WSEAS International Conference on Education and Educational Technology (EDU '11)</i>. WSEAS. Dix, A., Finlay, J., Abowd, G. D., & Beale, R. (2004). <i>Human-computer Interaction</i> (3rd ed.). London, UK: Pearson Education Limited. Nurulnadwan A., Nur H. M. R., & Ariffin, A. M. (2011). Visually-impaired children's acceptances on assistive courseware. <i>American Journal of Applied Sciences</i>, 8(10). 1019-1026.

Content Summary

6.1 Key issues in data gathering:

In data gathering, there are FOUR key issues designers have to understand:

- (a) **Setting goals** – the goals for collecting data must be very clear. This really helps in data gathering, in which goals have to be made tangible and clearly seen by the team members for reference at any time. The goals will drive the data gathering sessions.
- (b) **The relationship with the participants** – this is very important. Remember: the participants are not part of the team. So they are allowed to leave the data gathering session at any time. It is recommended that the participants are provided with a consent form, as this will increase their confidence to participate in the study. As a courtesy towards participants' involvement, some forms of token could be provided to them.
- (c) **Triangulation** – refers to a strategy that entails using more than one data source, or using more than one data analysis approach. This is necessary because different groups of people can be approached through different techniques.
- (d) **Pilot study** – It is a trial run of the main study, which is used to determine that certain techniques are viable for the study-in-purpose. Also, it is used to prove that the utilised apparatus works well as intended.

6.2 Data Recording

- (a) **Notes and still camera** – taking notes is the least technical way of recording. However, it is a little bit tiring to write everything down.
 - (i) Sometimes important points are left unrecorded;
 - (ii) A still camera helps in capturing events, but it does not capture continuous reactions;
 - (iii) Can be operated by a single person;

- (iv) Useful in recording interviews and quantitative lab experiments; and
 - (v) Semantic elements in the speech are difficult to be recorded in writing; cameras can come in handy in recording these down.
- (b) Audio and still camera
 - (i) Audio can capture semantic elements in speech;
 - (ii) Can capture rich continuous data without having to struggle with filtering between data and non-data;
 - (iii) Avoids tiredness in writing the data;
 - (iv) Useful in recording interviews and in think-aloud techniques;
 - (v) Cameras are able to capture rich data with audio recording; and
 - (vi) Cannot just capture the processes in continuous visual representation.
- (c) Video
 - (i) Is able to capture rich continuous data in which processes and reactions are recorded visually and with audio together;
 - (ii) The video recording could be replayed many times to extract the data; and
 - (iii) Now, video recorders are inexpensive and easy to handle.
- (d) Based on the descriptions earlier, you should be able to differentiate the techniques in terms of:
 - (i) Equipment;
 - (ii) Flexibility of use;
 - (iii) Completeness of data;
 - (iv) Disturbance to users;

- (v) Reliability of data; and
- (vi) Analysis.

6.3 Interviews

- (a) **Unstructured interview** – asking questions without guiding questions in mind, going with the flow during the interview.
 - (vi) More to exploratory form and conversation on certain topics.
 - (vi) Involves open questions to gather rich data.
 - (vi) Gathers a lot of data – very time-consuming to analyse.
 - (vi) Impossible to replicate – because it is very open and loose.
 - (vi) The interviewers are recommended to use audio or video recording and to later transcribe the data.
- (b) **Structured interview** – interviews are fully guided by pre-prepared questions.
 - (i) It is like answering a questionnaire and no other question is asked out of the questions already in hand.
 - (ii) Very straight forward and easy to execute. Time taken could be planned.
 - (iii) Normally, it is used after the goals are clear.
 - (iv) Questions should be short and precise, in closed form.
 - (v) Each participant is addressed with exactly similar questions.
- (c) **Semi-structured interview** – combines features of unstructured and structured interviews.
 - (i) The process starts with the pre-planned questions (in the structured interview), and could be interjected with unplanned questions when necessary (as in unstructured).
 - (ii) Can provide rich data, mostly on questions related to the pre-determined goals.
 - (iii) Probing is very useful to understand certain topics.

- (iv) Also, assisting the interviewees when they are stuck with a response is really helpful.
 - (v) Dealing with children is an example of suitable situations to use the semi-structured interview method.
- (d) **Focus group** – observing interviewees discussing a topic in a group.
- (i) Five to ten people in a group is good.
 - (ii) The group addresses a given topic and discusses this together.
 - (iii) Each member in the group is identified in terms of the roles they can play best.
 - (iv) The contents of discussion are rich, as a focus group allows participants to address issues that they are not commonly prompted on.
 - (v) Can be very relaxed, or can be formal – the interviewer has to play the role of a moderator to harmonise the session.
- (e) **Planning for interview** – the interviews have to be planned well. Questions should be developed for the interviewees personally. The place of interview has to be well-identified, the environment has to be considered. There are many factors to be considered to ensure the interviews are successful including:
- (i) Developing interview questions – the following are general tips for ensuring the interviewees understand the questions:
 - Compound sentences can be confusing – split the questions into a few, that are short and precise. Also this eases the recording and analysis of data.
 - Avoid using jargon or complex phrases. Use language the interviewees are familiar with.
 - Avoid bias questions, use neutral ones. Words like “why do you like this style...” could lead the interviewee to feel uncomfortable and to say otherwise.
 - Pre-prepare the possible answers in advance so that the answers are easily ticked off, rather than having to note similar answers many times over the course of different interviews.

(ii) Running the interview

- Before starting the interview, the goals of the interview should be communicated clearly to the interviewees, to ensure they understand the purpose of the interview.
- Understand their nature first, to make sure the execution of the interview is smooth.
- During the interview, listen more than you talk.
- The following is an example of how an interview could be segmented:
 - Introduction – introduce the interviewer and the reason for the interview. Address the ethical issues that could arise from the interview and ask for permission to record the session.
 - Warm-up session – non-threatening questions should come first, including asking about demographic information.
 - The main session – present the questions in a logical structure, with more probing at the end. In a semi-structured interview, questions can be varied among the interviewees.
 - Cool-off period – ask easy questions to release the tense mood.
 - Closing – convey appreciation to the interviewees. Tokens are recommended.

6.4 Questionnaires – a well-established way of collecting demographic information and opinions.

- (a) It has the potential to reach a big number of participants and obtain opinions anonymously with less cost in a short period of time. However, sometimes, the return rate is extremely low.
- (b) It requires a big number of questionnaires for sufficient data, in which the common rate of success is 10% (only 100 returned questionnaires can be expected from the 1,000 distributed).
- (c) Questionnaires can also be used in interviews, when the participants are not answering independently (such as interview sessions with CEOs, or cases where the questions need proper and critical explanation and guidance).

- (d) To make sure the questionnaire is successful; it has to be administered carefully after being effectively planned.
- (e) The design of the questionnaire – one needs to remember that the way the questions are phrased and asked will determine whether the participants answer honestly or otherwise. There are two different situations; they answer and they answer honestly. In accordance to this, here are a list of tips to invoke the participants' interest to answer honestly:
 - (i) Plan the order of questions – the impact of a question can be influenced by the order of the questions;
 - (ii) Consider a different set of questionnaire for different groups of participants;
 - (iii) Provide clear instructions on how to complete the questionnaire;
 - (iv) Balance between the white space and the need to keep the questionnaire compact – long questionnaires will trigger participants' to think about “cost” and “deter” them from being communicative (invokes their internal unhappiness);
 - (v) Ease participants' tasks in answering by providing options of answers rather than expecting them to write everything themselves;
 - (vi) Refer to the Internet for samples of questionnaire designs; and
 - (vii) Among the rating formats that ease participants' tasks are:
 - Check boxes and range – allowing participants to select more than one option (such as interest).
 - Radio button – provided for questions with only one true answer (such as gender).

- Rating scales – to ascertain the level of agreement with certain statements.
 - Tick
- (f) **Online questionnaire** – now, online questionnaires are really helpful, but only for participants who are connected to the Internet. This is not a reliable form of gathering data from school children in rural areas for instance. Many tools are provided for free to create online questionnaires (search the Internet using keywords such as “online survey” or “online questionnaire” to find some). Some benefits include:
- (i) The cost for conducting an online questionnaire is low;
 - (ii) It can reach a big population easily;
 - (iii) Very easy to administer; and
 - (iv) It is quick.

6.5 Observation – is a useful data gathering technique at any stage during the development of the prototype. At the early development stage, observation helps in understanding the context of use and the current problem, while in later development stages, observation helps in investigating how well the developing prototype supports the tasks of goals of the users. It could be carried out directly or indirectly and either in the field or in a controlled environment.

- (a) **Direct observation in the field** – this helps to get right to what users have to do and how they do their tasks in their own personal context. It is important to examine them in their surroundings, because in most cases they are not able to explain everything in words. Although this technique is very useful, it is very complicated, and often leads to too much collection of noise (which is regarded as data). Some tips for this observation are:
- (i) The goals of the observation must be clear from the beginning. Then the operation should balance between the goals and being open for the possibility of modifying, shaping and refocusing of these goals.
 - (ii) Observers have to be open to flexibility, to be in line with the context of observation.

- (iii) A simple framework that consists of three items to look for in a direct observation is as follow:
 - The person – who is using the system/product at any particular time?
 - The place – where are they using it?
 - The thing – what are they doing with it?
- (iv) Observers are encouraged to pay greater attention to the context of the activity they are observing:
 - Space – what is the physical space like and how is it laid out?
 - Actors – what are the names and relevant details of the people involved?
 - Activities – what are the actors doing and why?
 - Objects – what physical objects are present, such as furniture?
 - Acts – what are specific individual actions?
 - Events – is what is being observed part of a special event?
 - Time – what is the sequence of events?
 - Goals – what are the actors trying to accomplish?
 - Feeling – what is the mood of the group and of individuals?
- (v) Observers can choose to be either active or passive in their observation.
 - Active observers – take part in subjects' tasks. This enables the observers to understand the tasks deeply and to empathise with the subjects' feelings and emotions.
 - Passive observers – these observers only observe the processes taking place, without participating in them.

- (vi) **Ethnography** – very famously used in social sciences. Observers stay together with the group being observed for a period of time, until they are accepted by the people being observed as part of them. Studying about the culture of indigenous people is often done utilising this technique.
- It enables the observer to collect very rich data and gathering the data is not hard.
 - Among the information that could be collected through ethnographic approach are:
 - Activities or job descriptions;
 - Rules and procedures;
 - Descriptions of activities observed;
 - Recording of the conversations taking place between parties involved in the observed activities;
 - Informal interviews with the participants explaining the details of the activities being observed;
 - Diagrams of physical layouts;
 - Photographs of artefacts;
 - Videos of artefacts;
 - Descriptions of artefacts;
 - Workflow diagrams explaining involved processes; and
 - Process maps showing connections.
- (b) **Direct observation in a controlled environment** – always involved in usability labs. Recording techniques can be similar with those in the field and can also be adapted suitably for a lab environment.
- (i) The procedures are similar to that of interviews.
 - (ii) In a usability setting a few cameras are placed on the wall to capture participants' body language and gestures.
 - (iii) The noise is highly controlled, to prevent any form of distraction, especially those that take away the participants' attention and focus.

- (iv) Think-aloud protocol (TAP) is used to gather the participants thoughts while performing the tasks (because it is very hard if the thoughts are not expressed orally).
- (v) It is very helpful in gathering data and the TAP session has to be audio-recorded.
- (c) **Indirect observation: tracking the participant's activities** – sometimes, their interaction has to be tracked indirectly.
 - (i) Diaries – participants write their activities in a diary (answering the questions listed in the direct observation).
 - (ii) Interaction log – using specific tools to record participants' interaction with the system/product.

6.6 Data analysis and presentation – having collected data from the participants through various techniques, the data has to be analysed and presented in a form that enables the information to be easily understood. Some are efficiently done using the quantitative approach while others are more efficient through the qualitative approach.

- (a) Quantitative data analysis and presentation is done using numerical representations. Some of its common representations include:
 - (i) Means;
 - (ii) Percentage;
 - (iii) Descriptive;
 - (iv) Graphs (pie, histogram, line, scatter plot, time series, etc);
 - (v) Tables;
 - (vi) Cross tabulation; and
 - (vii) These are very objective and show clear understanding. They can address comparison, patterns, preference, visualisation and so on.

- (b) Qualitative data analysis and presentation is done using explanatory description. This can include:
 - (i) Quotations;
 - (ii) Scripts;
 - (iii) Scenarios;
 - (iv) Synthesis;
 - (v) Deduction;
 - (vi) They can complement the quantitative findings, explaining the reasons for the patterns or trends or the like; and
 - (vii) They can also stand on their own by deeply understanding a certain situation.
- (c) There are certain tools that help the data analysis and presentation process. The tools used are different for qualitative and quantitative approaches.

Study Questions

1. What are the different techniques that can be used for gathering data? When can the techniques be suitably applied?
2. What are the advantages of using an interview approach over the questionnaire approach?
3. Describe the note-taking techniques during interviews and observations.
4. Differentiate the qualitative and quantitative techniques.

Topic 7: The Process of Interaction Design

Learning Outcomes

By the end of this topic, you should be able to:

1. Describe what is involved in interaction design;
2. Discuss the importance and benefits of involving users in the development of interaction design;
3. Identify the main principles of user-centred design;
4. Explain the interaction design process; and
5. Describe the lifecycle models.

Topic Overview

Interaction designers have to understand the systematic and scientific approach towards designing and developing interactive products. Thus, some product development lifecycles are introduced in this topic to aid in this understanding. Most of the issues discussed in previous topics, from understanding users to gathering and analysing data are all a part of the lifecycle. Hence, this topic is very important to provide a platform to put the issues together in a canvas, to draw a big picture of the process of designing and developing design.

Focus Areas and Assigned Readings

Focus Areas	Assigned Readings
7.1 What is involved in Interaction Design? 7.2 Some Practical Issues 7.3 Lifecycle Models	Sharp, H., Yvonne, R., & Jenny, P. (2007). <i>Interaction design: Beyond human-computer interaction</i> (2nd ed.). West Sussex, England: John Wiley & Sons Ltd. <i>Chapter 9, pp 412 - 414.</i> <i>Chapter 9, pp 414 - 430.</i> <i>Chapter 9, pp 430 - 444.</i> Additional Recommended Readings Schneiderman, B. (1998). <i>Designing the user interface. Strategies for effective human-computer interaction</i> (3rd ed.). Reading, MA: Addison-Wesley.

Content Summary

7.1 What is involved in interaction design?

- (a) Thinking;
- (b) Planning;
- (c) Communicating;
- (d) Collaborating; and
- (e) Users – involving users is a must. Why?
 - (i) To find out the right user requirements from the very people who directly use the system.
 - (ii) To exceed the users' expectations rather than being below expectation.

- (iii) Explanations by a secondary party (such as managers) are not genuine and may not comprehensibly convey the right meaning.
 - (iv) Degree of user involvement – depends on the requirement, which is subject to the state of the art. Sometimes users are engaged very closely, sometimes they are just partly involved.
- (f) User-centred approach – is important to ensure that products/systems meet users' requirements (needs). The following are three principles that are key in leading to the development of useful and easy to use computer systems:
- (i) Early focus on users and tasks – the first requirement in interaction design is to understand the users and their tasks.
 - (ii) Empirical measurement – always get empirical measurement for understanding reactions, trends, scenarios and the like.
 - (iii) Iterative design – designs should be devised many times and involve an assessment at the end of every design.
- (g) There are four basic activities in interaction design:
- (i) Identifying needs and establishing requirements for the user experience;
 - (ii) Developing alternative designs that meet those requirements;
 - (iii) Building interactive versions of the designs; and
 - (iv) Evaluating the artefacts being built through the process and the user experience it offers.

7.2 Some practical issues

- (a) Who are the users?
- (i) Users of a system vary, are not only just a single person. They are direct users who are going to use the system.
 - (ii) All users have to be known, including their characteristics and demographic background.

- (iii) They have specific behaviours that are different from other groups.
- (iv) Those who manage the direct users should also be considered.
- (v) Those who provide the financial ability are also considered.
- (vi) Those who train the direct users must also be considered.
- (b) What do we mean by needs?
 - (i) Always go back to usability goals and user experience goals – these are the needs.
- (c) How do you generate alternative designs?
 - (i) Inspired by the existing ones;
 - (ii) Inspired by those in other locations;
 - (iii) Inspired through experience;
 - (iv) Inspired through printed materials;
 - (v) Inspired through peers;
 - (vi) Inspired through superiors; and
 - (vii) Dilemma: whether it is copying or it is derived from inspiration.
- (d) How do you choose among the alternatives?
 - (i) Users have to be involved in the design process.
 - (ii) Observation and interview should be involved.
 - (iii) Analysis of data leads to the selection.

(e) Lifecycle models - Shows how the activities are related to one another

(i) A simple lifecycle model for interaction design is as follows (see Figure 7.1):

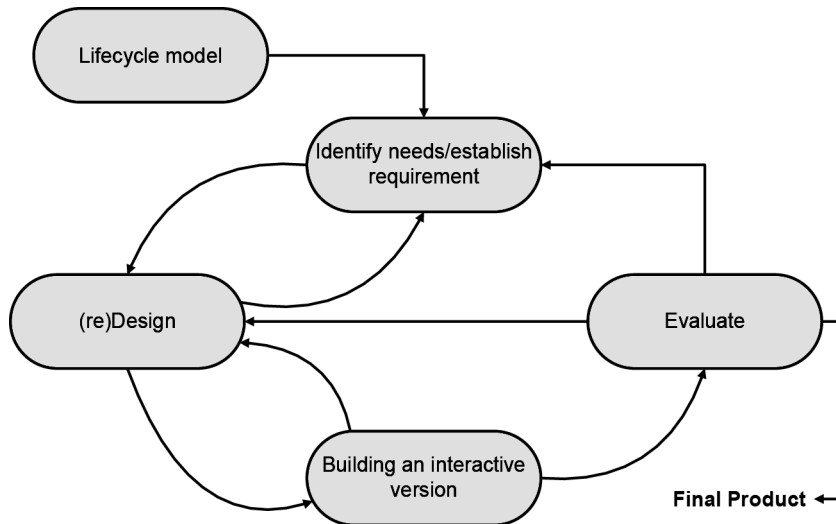


Figure 7.1: Simple lifecycle model

(ii) An example of a lifecycle model used in software engineering is the waterfall lifecycle model (refer to Figure 7.2).

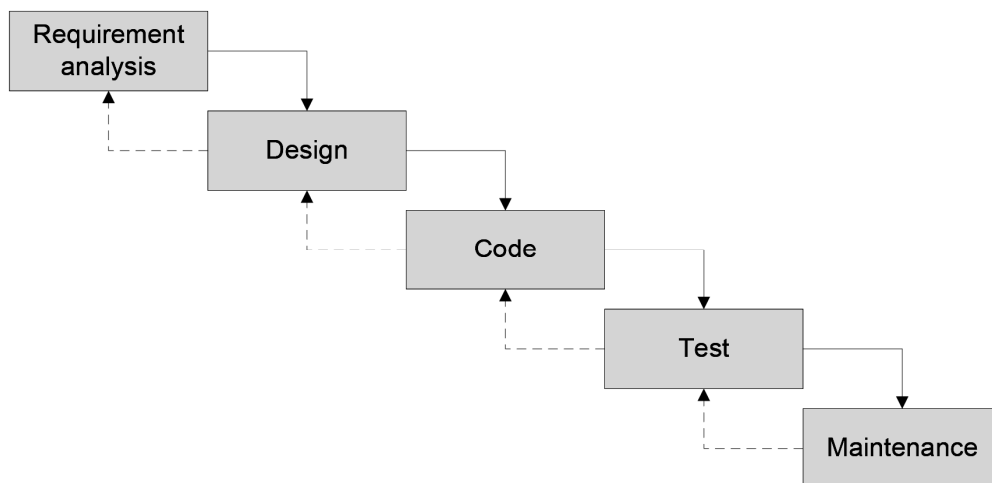


Figure 7.2: Waterfall lifecycle

- (iii) Spiral lifecycle model. Refer to Figure 7.3 for an example of the spiral lifecycle model.

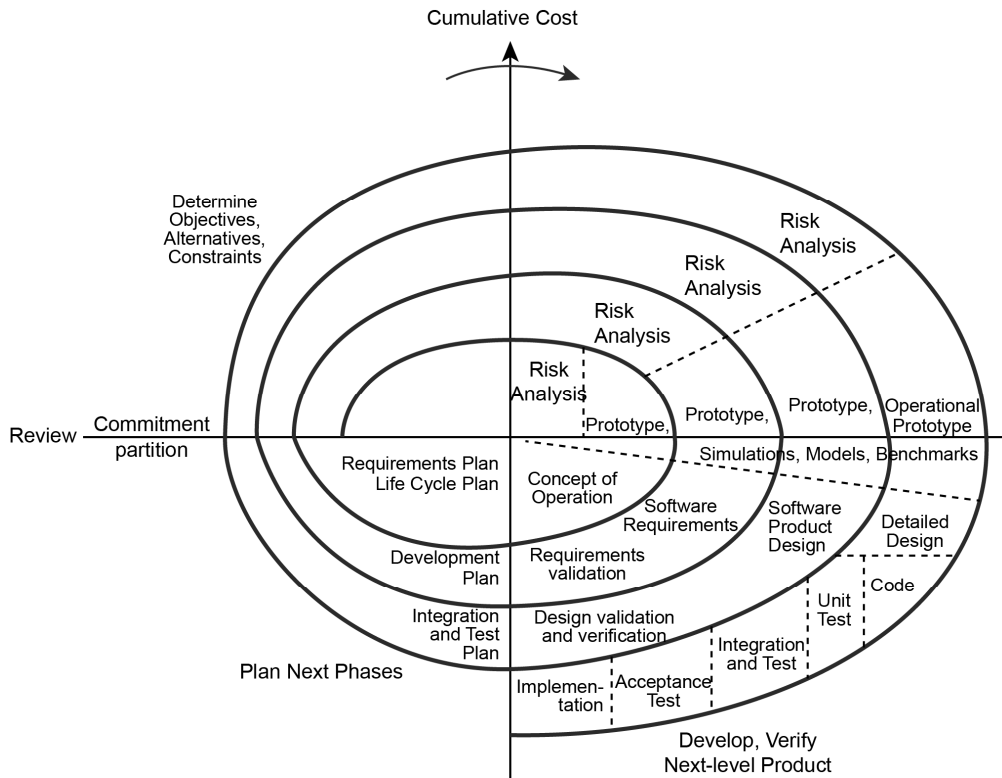


Figure 7.3: Spiral lifecycle

- (iv) Rapid application development. Refer to Figure 7.4 for a rapid application development lifecycle.

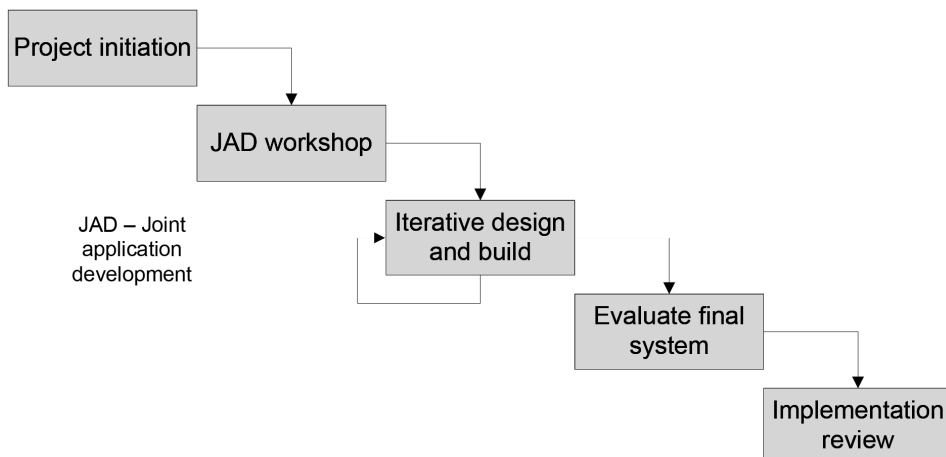


Figure 7.4: Rapid application development lifecycle

- (v) Agile development lifecycle. Refer to Figure 7.5 for the agile development lifecycle.

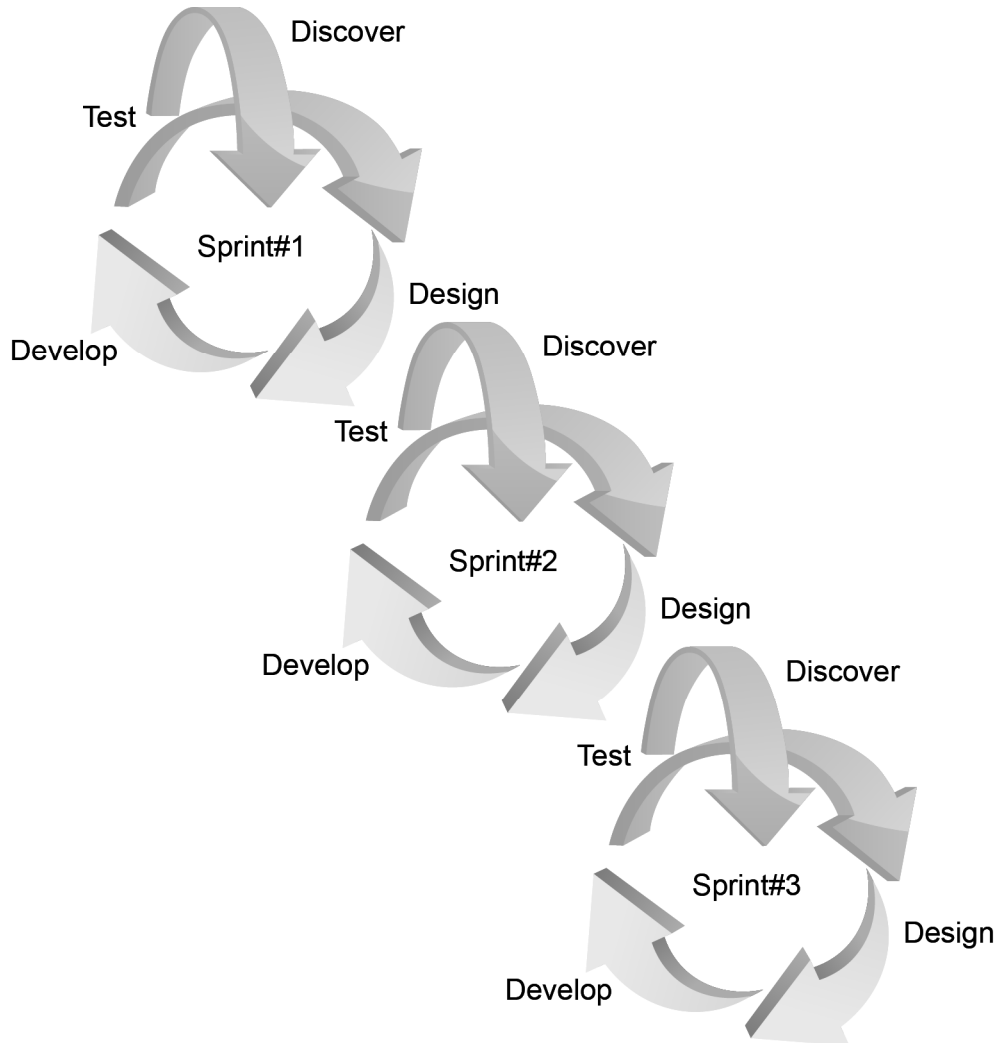


Figure 7.5: Agile development lifecycle

(vi) Lifecycle model in HCI

- The Star lifecycle model (refer to Figure 7.6).

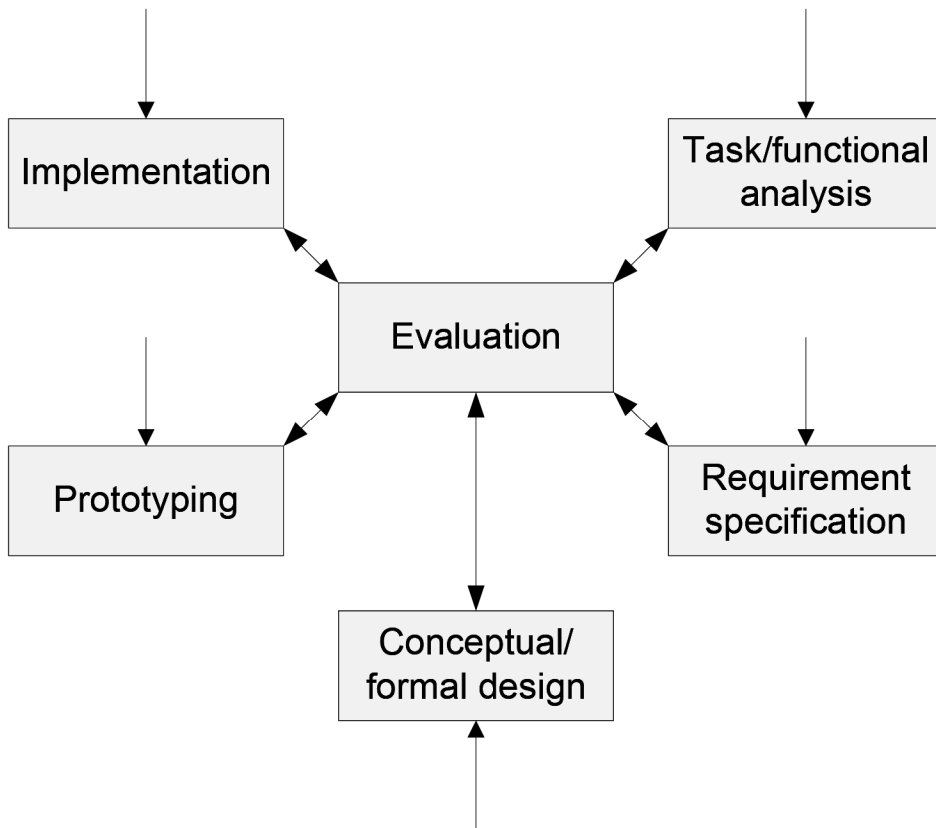


Figure 7.6: Star lifecycle

- The usability engineering lifecycle (refer to Figure 7.7 for an example).

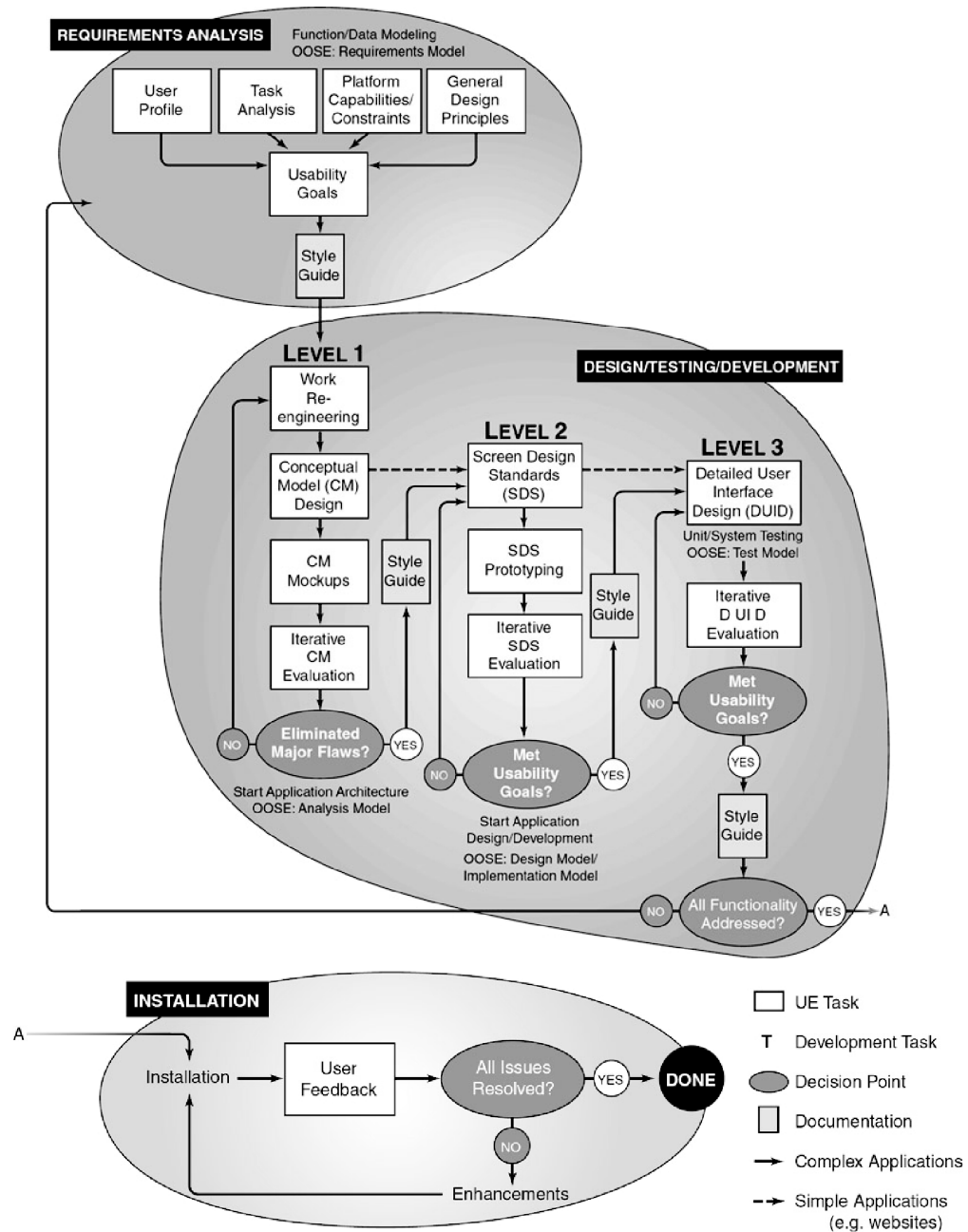


Figure 7.7: Usability engineering lifecycle

- ISO 13407 Human-centred design processes for an interactive system (see Figure 7.8).

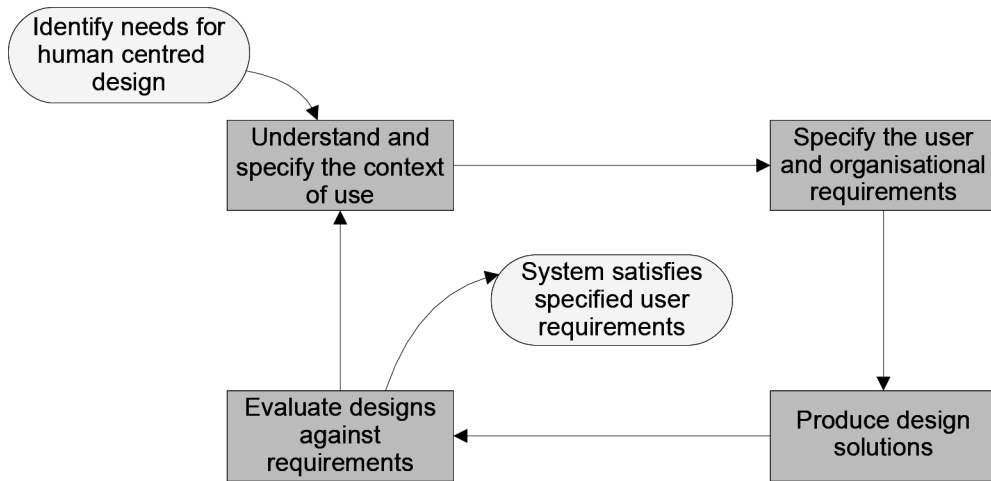


Figure 7.8: ISO 13407 Human-centred design

Study Questions

1. What is involved in interaction design?
2. Why is involving users important?
3. Discuss the main principles of interaction design.
4. Describe the design lifecycles.

Topic 8: Identifying Needs and Establishing Requirements

Learning Outcomes

By the end of this topic, you should be able to:

1. Describe different kinds of requirements;
2. Explain how data gathering techniques can be utilised in establishing requirements; and
3. Identify problem-solving steps in task analysis.

Topic Overview

The needs and requirements of users are the foundation of interaction design. They have to be very clear before the designing commences. Understanding them is not a straightforward task, but requires massive work, involving various techniques. In fact, the techniques differ between different contexts and amongst the people that are dealt with. Having discussed about the lifecycle in Topic 7, this topic delves further into discussions regarding the importance of clearly stating the needs and requirements of users. Many ways can be used to identify the needs and establish the requirements, which are both necessary in ensuring that the whole design team has a similar and clear understanding of what is required.

Focus Areas and Assigned Readings

Focus Areas	Assigned Readings
8.1 What, How and Why? 8.2 What are Requirements? 8.3 Data Gathering and Requirements 8.4 Data Analysis, Interpretation and Presentation 8.5 Task Description and Task Analysis	Sharp, H., Yvonne, R., & Jenny, P. (2007). <i>Interaction design: Beyond human-computer interaction</i> (2nd ed.). West Sussex, England: John Wiley & Sons Ltd. <i>Chapter 10, pp 474 - 476.</i> <i>Chapter 10, pp 476 - 489.</i> <i>Chapter 10, pp 489 - 500.</i> <i>Chapter 10, pp 500 - 504.</i> <i>Chapter 10, pp 504 - 520.</i> Additional Recommended Readings Nurulnadwan A., Nur, H. M. R., & Ariffin, A. M. (2011). Visually-impaired children's acceptances on assistive courseware. <i>American Journal of Applied Sciences</i>, 8(10). 1019-1026.

Content Summary

8.1 What, how and why?

- (a) What are we trying to achieve in terms of requirements? The two aims are:
 - (i) To understand users, their tasks and the context of these tasks; and
 - (ii) To produce a set of stable requirements to form the basis of the tasks that has to be carried out.
- (b) How can we achieve this?
 - (i) This requires a lot of work, involving users through various techniques (triangulating the techniques and source of data).
 - (ii) Iterative works are commonly necessary.

- (iii) Representation of information is critical to ensure users understand and are able to provide feedback on the proposed designs.
- (c) Why bother? The importance of getting it right.
 - (i) Understanding the requirements is highly important; it is the first task that should be done after the problem has been well-defined.
 - (ii) Consider the importance of this through the illustration in Figure 8.1:

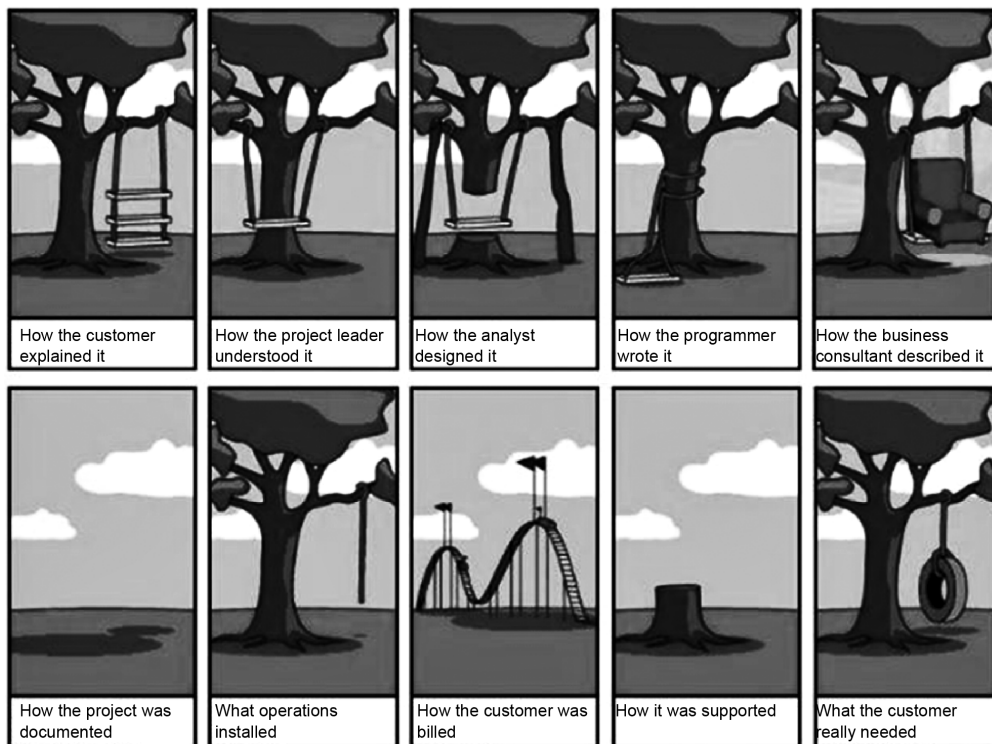


Figure 8.1: Mismatch in information interpretation

Source: http://blog.optimalbi.com/wp-content/uploads/2014/02/requirements_accavdar.jpg

- (d) Why establish requirements?
 - (i) When developing a house, the requirement of the house is necessary. The requirements have to come from the owner, whilst the engineer, architect and the contractor can provide their suggestions. The suggestions are then tailored with the needs of the owner.
 - (ii) When the architect, engineer and contractor understand the needs and requirement similarly, the actual house can then be designed and developed.

8.2 What are requirements?

- (a) Statements of what a system should do and how it should perform.
- (b) It has to be specific, unambiguous and clear.
- (c) Comes in different forms and different levels of abstraction.
- (d) There are different kinds of requirements including:
 - (i) Functional requirement;
 - (ii) Data requirement;
 - (iii) Environmental requirement or context of use;
 - (iv) User characteristics or profile; and
 - (v) Usability goals and user experience goals.

8.3 Data gathering and requirements include:

- (a) Interview;
- (b) Observation;
- (c) Questionnaire;
- (d) Document study; and
- (e) Contextual inquiry.

8.4 Data analysis, interpretation and presentation:

- (a) Among the tools to help generate ideas while designing include:
 - (i) Class diagram, interaction diagram and database design;
 - (ii) Context diagram and data flow diagram;
 - (iii) Screen sketch; and
 - (iv) Storyboard.
- (b) Always brainstorm for innovative ideas.

8.5 Task description and task analysis:

- (a) Scenario – a description of the scenario in which a system is within consideration. It is elaborative, in a nice storyline to keep designers interested.
- (b) Hierarchical task analysis – the steps of performing the tasks are detailed into a few subtasks and labelled with the sequence of steps (see Figure 8.2 for an example of this).

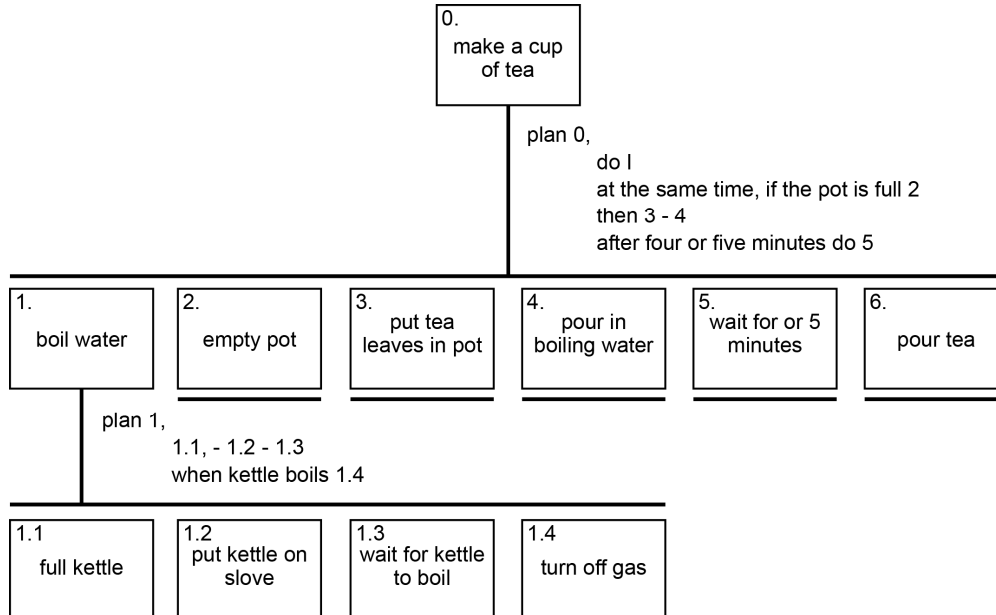


Figure 8.2: Hierarchical task analysis

Source: <http://alandix.com/academic/papers/HCI-intro-94/images/tea256.gif>.

Study Questions

1. What are requirements?
2. Discuss the different kinds of requirements.
3. Describe the techniques for collecting data for establishing requirements.
4. Describe a scenario.
5. What is task description?

Topic 9: Design, Prototyping and Construction

Learning Outcomes

By the end of this topic, you should be able to:

1. Describe prototyping and the different types of prototyping activities; and
2. Produce simple prototypes from the models developed during the requirements activities.

Topic Overview

After the requirement has been established, the designing will commence. This is the most interesting stage in development works, because everything is clear cut by this stage and this stage is to turn the requirement into a realisation. Based on the design artefacts, the prototyping starts, followed with construction. This is a very interesting topic as it discusses the processes involved in making the designs into a prototype. The different levels of prototyping are addressed and discussed at length to ensure that future designers are able to understand the variation in ways to convey ideas.

Focus Areas and Assigned Readings

Focus Areas	Assigned Readings
9.1 Prototyping and Construction 9.2 Conceptual Design 9.3 Physical Design	Sharp, H., Yvonne, R., & Jenny, P. (2007). <i>Interaction design: Beyond human-computer interaction</i> (2nd ed.). West Sussex, England: John Wiley & Sons Ltd. <i>Chapter 11, pp 530 - 540.</i> <i>Chapter 11, pp 540 - 551.</i> <i>Chapter 11, pp 551 - 554.</i> Additional Recommended Readings Zatul A. S., Nurulnadwan A., Ariffin A. M., & Mohd S., J. (2011). Assistive Courseware for Hearing-impaired Learners in Malaysia based on Theory of Multiple Intelligence (MI). <i>International Journal of Computer Sciences and Emerging Technologies</i>, 2(6), 370-377.

Content Summary

9.1 Prototyping and construction

- (a) What is a prototype?
- (i) A prototype is a limited representation of the actual system/product. For example:
 - Small-scaled bridge made of wood.
 - Machine made of foam.
 - Paper-based mobile phone.
 - (ii) Comes in different forms at different levels of development. The closer it gets to the final product/system, the more functional it becomes.

- (b) What is the purpose of a prototype?
- (i) It brings up ideas for discussion and serves as a communication device among the designers.
 - (ii) It supports the selection of alternatives.
 - (iii) It is used to understand navigational styles and decide on the best one.
 - (iv) To understand the screen layout and structure.
 - (v) To understand the contents.
 - (vi) To determine the technical aspects of the system/product.
- (c) Low-fidelity prototype
- (i) Prototypes in the early stage of the development work.
 - (ii) Easy to create, but very meaningful to set the foundation.
 - (iii) Uses materials that are different from that of the final product:
 - Storyboard;
 - Sketch;
 - Index cards; and
 - Post-it notes.
- (d) High-fidelity prototype
- (i) Uses similar materials with the final product/system.
 - (ii) For a system, a high-fidelity prototype already uses tools similar with the actual system.
 - (iii) Conveys functions available in the actual system.
 - For a database system, database in Visual Basic or Ms. Access are good high-fidelity prototypes.
 - They require additional effort to be developed. However, they are often supported by other low-fidelity prototypes.

9.2 Conceptual design: Moving from requirement to first design:

What is a conceptual design?

- (a) A high representation of a system/product. It explains what the system can do and how it does it.
- (b) It should address the usability and user experience goals.
- (c) Consider these:
 - (i) Which interface metaphor would be most suitable to help users understand the system?
 - (ii) Which interaction type(s) would best support the users' activities?
 - (iii) Do different interface types suggest alternative design insights or options?

9.3 Physical design: Getting concrete:

Physical design refers to designing for the actual product. For computer applications, colours, layout, structures, visual and audio are actual in physical design.

Study Questions

1. Describe the different types of prototyping.
2. Explain the importance of prototyping.
3. Can prototypes generate ideas for the actual product or systems?

Topic 10: Evaluation

Learning Outcomes

By the end of this topic, you should be able to:

1. Explain the key concepts and approaches of evaluation;
2. Describe the key evaluation methods within the context of real evaluation studies;
3. Discuss the DECIDE framework;
4. Examine the methods used in usability testing;
5. Illustrate how heuristic evaluation can be adapted to evaluate different types of interactive products;
6. Explain the process of heuristic evaluation and various kinds of walkthrough; and
7. Describe how to perform predictive techniques, GOMS and Fitts' Law, and also when to use them.

Topic Overview

This topic covers the topic of evaluation which is a crucial part in designing and developing works. Evaluation works are the ultimate step to ensure that the product being developed is usable for the intended users. In evaluating the product, both usability and user experience should be catered to. Various techniques can be used to gather feedbacks. They are in fact used for different purposes and at different points in the design and development works.

Focus Areas and Assigned Readings

Focus Areas	Assigned Readings
10.1 Why is there a need to Evaluate? 10.2 What to Evaluate? 10.3 Where to Evaluate 10.4 When to Evaluate 10.5 Evaluation Approaches and Methods 10.6 DECIDE: A Framework to Guide Evaluation 10.7 Usability Testing 10.8 Field Study 10.9 Inspection: Heuristic Evaluation 10.10 Inspection: Walkthroughs 10.11 Predictive Models	Sharp, H., Yvonne, R., & Jenny, P. (2007). <i>Interaction design: Beyond human-computer interaction</i> (2nd Ed.). West Sussex, England: John Wiley & Sons Ltd. Chapter 12, pp 586 – 586. Chapter 12, pp 586 – 588. Chapter 12, pp 588 – 588. Chapter 12, pp 589 – 590. Chapter 12, pp 590 – 595. Chapter 13, pp 626 – 641. Chapter 14, pp 646 – 666. Chapter 14, pp 667 – 678. Chapter 15, pp 686 – 702. Chapter 15, pp 702 – 706. Chapter 15, pp 706 – 714. Additional Recommended Readings Azham, H., Maria, K., Ariffin, A. M., & Fazillah, M. K. (2012). Modeling subjective metrics for mobile evaluation. <i>Journal of Research and Innovation in Information Systems</i>, 1, 11-20. Ariffin, A. M., Mohd, H. A. W., & Norshuhada, S. (2009). <i>Measures for Entertaining and Fun-Of-Use</i>. <i>MASAUM Journal of Survey and Reviews</i>, 1(1), 51 – 61. Mayhew, D. J. (1999). <i>The usability engineering lifecycle</i>. San Francisco, CA: Morgan Kaufmann.

Content Summary

10.1 Why is there a need to evaluate?

- (a) To check that users can use the product or system and that they like it, particularly if the design is new.
- (b) Furthermore, now users not only seek for usability of products or systems but also for a pleasing and engaging experience with the products/systems.

10.2 What to evaluate?

It varies, depending on the time state and the objective of the evaluation.

10.3 Where to evaluate?

- (a) In a laboratory; and
- (b) In the field or natural setting.

10.4 When to evaluate?

- (a) This varies, depending on the objectives of the assessment.
- (b) As early as the screen sketch stage of development, evaluation can begin to take place.

10.5 Evaluation approaches and methods include:

- (a) Approaches
 - (i) Usability testing;
 - (ii) Field studies; and
 - (iii) Analytical evaluation.
- (b) Methods
 - (i) Observing users;
 - (ii) Asking users;
 - (iii) Asking experts;

- (iv) Testing users' performance; and
- (v) Modelling users task performance.

10.6 DECIDE: A framework to guide evaluation:

- (a) D – determine the goals.
- (b) E – explore the questions.
- (c) C – choose the evaluation approach and methods.
- (d) I – identify the practical issues.
- (e) D – decide how to deal with ethical issues.
- (f) E – evaluate, analyse, interpret and present the data gathered.

10.7 Usability Testing:

- (a) An approach that emphasises the property of being usable (i.e. the product is being tested, not the users). Testing is usually carried out in a controlled usability lab.
- (b) The aim is to determine whether the system being assessed is usable for the intended users.
- (c) Data is collected using various techniques.
- (d) The key components are user tests and user satisfaction questionnaires. The user test measures human performance on specific tasks, meanwhile the questionnaire is to gather data on how users feel while interacting with the system.
- (e) The combined measures are analysed to determine if the design is efficient and effective.
- (f) Interviews (structured and semi-structured) can also be carried out with the users.

- (g) Time and numbers are the two main measures used. The following are common areas of focus:
- (i) Time taken to complete a task.
 - (ii) Time taken to complete a task after a specified time of being away from the product.
 - (iii) Number and type of errors per task.
 - (iv) Number of errors per unit of time.
 - (v) Number of navigations to online help or manuals.
 - (vi) Number of users making a particular error.
 - (vii) Number of users completing a task successfully.
- (h) The lab consists of an observer area and participants' area separated by a one-way mirror (like in Figure 10.1). The participants are not able to see the observer and do not realise that they are being observed.

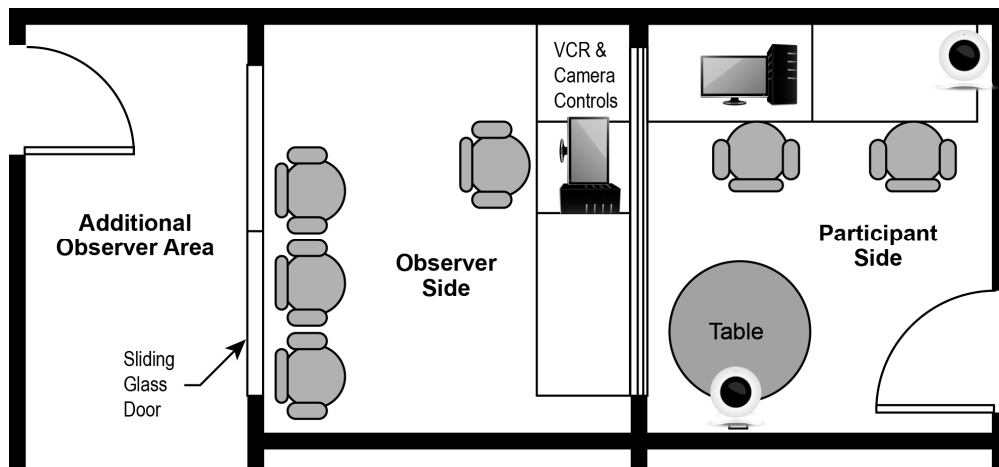


Figure 10.1: Setting of the usability lab

- (i) The participants must be selected from among the real users.
- (j) A few tasks must be planned to cover the whole parts in the system.

10.8 Field study:

- (a) It is conducted to find out how a product or prototype is adopted and used by people in their working and everyday lives.
- (b) It is different from the controlled environment technique. This technique is messy (activities often overlap and are constantly interrupted).
- (c) It could range in time from just a few minutes to a period of months or even years.
- (d) Primary data are collected through observing and interviewing people; collecting video, audio and field notes. Also, participants could be requested to provide a diary.
- (e) This technique often results in the collection of very rich data, beyond the specified goals.

10.9 Inspection: Heuristic evaluation:

- (a) Experts involved in the test are guided by a set of usability principles known as heuristics. It is used to evaluate whether the user-interface elements conform to the principles.
- (b) The following are the heuristics principles:
 - (i) Visibility of system status.
 - (ii) A match between the system and the real world.
 - (iii) User control and freedom.
 - (iv) Consistency and standards.
 - (v) Error prevention.
 - (vi) Recognition rather than recall.
 - (vii) Flexibility and efficiency of use.
 - (viii) Aesthetic and minimalist design.
 - (ix) Help users recognise, diagnose and recover from errors.
 - (x) Help and documentation.

- (c) Based on the principles, questions could be drafted to be in line with the system being evaluated.
- (d) Three to five experts are usually involved in the test.
- (e) Segmented into three parts:
 - (i) Briefing – experts are given an explanation about the test (what they should do).
 - (ii) Evaluation period – 1-2 hours for the evaluation. The experts need to take at least two passes through the interface. The first pass gives a feel for the flow of the interaction and the system's scope. The second pass allows the experts to focus on specific interface elements and to identify potential usability problems.
 - (iii) Debriefing – the experts come together to discuss their findings and to prioritise the problems they have found and suggest possible solutions for them.

10.10 Inspection: Walkthroughs

- (a) It is an alternative to heuristic evaluation for predicting users' problems without doing user testing. It involves walking through the system using specified tasks to note potential usability problems. Most walkthrough techniques do not involve users, unless the pluralistic walkthrough that is performed involving a group includes users as well..
- (b) Cognitive walkthrough:
 - (i) The steps are:
 - The characteristics of typical users are identified and documented and sample tasks are developed that focus on the aspects of the design to be evaluated.
 - A designer and one or more expert evaluators then come together to do the analysis.

- The evaluators walk through the action sequences for each task, placing it within the context of a typical scenario. While doing that, they try to answer the following questions:
 - Will the correct action be sufficiently evident to the users? (Will the users know what to do to achieve the task?)
 - Will the users notice that the correct action is available? (Can they see the button or menu item?)
 - Will the users associate and interpret the response from the action correctly?
 - (ii) As the walkthrough is taking place, a record of critical information is compiled, in which:
 - The assumptions about what could cause problems and why they are recorded. This involves explaining why users might face difficulties in certain areas.
 - Notes about side issues and design changes are made as well.
 - A summary of the results is then compiled.
 - (iii) The design is then revised to fix the problems that have been identified.
- (c) Pluralistic walkthrough
- (i) Users, developers and usability experts' work together to step through a scenario, discussing usability issues associated with dialog elements involved in the various steps of the scenario.
 - (ii) The roles of typical users are assumed and the walkthrough is done following these sequence of steps:
 - Scenarios are developed – a series of hardcopy screens representing a single path through the interface.
 - The scenarios are presented to the panel of evaluators and the panellists are asked to write down the sequence of actions they would take to move from one screen to another (this is done individually).

- When everyone has written down their actions, the panellists discuss the actions they have suggested. This is a part of the review round.
- Then the panel moves on to the next round. This process continues until all the scenarios have been evaluated.

10.11 Predictive models include:

- (a) GOMS model – an attempt to model the knowledge and cognitive processes involved when users interact with systems. The term GOMS is an acronym for goals, operators, methods and selection rules.
- (b) The keystroke level model – provides actual numerical predictions of user performance. Tasks can be compared in terms of the time taken to perform them when using different strategies.
- (c) Fitts' law – predicts the time it takes to reach a target using a pointing device.

Study Questions

1. What are the different techniques to get insights from an expert on a product/system?
2. Describe the DECIDE framework.
3. Discuss the differences between usability testing and field study in terms of purpose, procedure and the people involved.
4. How do heuristic and walkthrough help in designing? How are they different from one another?

Appendices

Appendix A: Learning Support

Tutorials

There are eight hours of face-to-face facilitation, in the form of FOUR tutorials of two hours each. You will be notified of the date, time and location of these tutorials, together with the name and e-mail address of your facilitator, as soon as you are allocated a group.

Discussion and Participation

Besides the face-to-face tutorials, you have the support of online discussions in myINSPIRE with your facilitator and coursemates. Your contributions to online discussions will greatly enhance your understanding of the course content, and help you do the assignment(s) and prepare for the examination.

Feedback and Input from Facilitator

As you work on the activities and the assigned text(s), your facilitator will provide assistance to you throughout the duration of the course. Should you need assistance at any time, do not hesitate to contact your facilitator and discuss your problems with him/her.

Bear in mind that communication is important for you to be able to get the most out of this course. Therefore, you should, at all times, be in touch with your facilitator, e-facilitator and coursemates, and be aware of all the requirements for successful completion of the course.

Tan Sri Dr Abdullah Sanusi (TSDAS) Digital Library

The TSDAS Digital Library has a wide range of print and online resources for the use of its learners. This comprehensive digital library provides access to more than 30 online databases comprising e-journals, e-theses, e-books and more. Examples of databases available are EBSCOhost, ProQuest, SpringerLink, Books24x7, InfoSci Books, Emerald Management Plus and Ebrary Electronic Books. As an OUM learner, you are encouraged to make full use of the resources available through this library.

Appendix B: Study Tips

Time Commitments for Study

You should plan to spend about 12 hours of study time on each topic, which includes doing all assigned readings and activities. You must also set aside time to discuss work online. It is often more effective to distribute the study hours over a number of days rather than spend a whole day studying one topic.

Study Strategy

The following is a proposed strategy for working through the course. If you have difficulty following this strategy, discuss your problems with your facilitator either through the online forum or during the tutorials.

- (i) The most important step is to read the contents of this Study Guide thoroughly.
- (ii) Organise a study schedule (as recommended in Table 2). Take note of the amount of time you spend on each topic as well as the dates for submission of assignment(s), tutorials and examination.
- (iii) Once you have created a study schedule, make every effort to stick to it. One reason learners are unable to cope with postgraduate courses is that they procrastinate and delay completing their course work.
- (iv) You are encouraged to do the following:
 - Read the Study Guide carefully and look through the list of topics covered. Try to examine each topic in relation to other topics.
 - Complete all assigned readings and go through as many supplementary texts as possible to get a broader understanding of the course content.
 - Go through all the activities and study questions to better understand the various concepts and facts presented in a topic.
 - Draw ideas from a large number of readings as you work on the assignments. Work regularly on the assignments as the semester progresses so that you are able to systematically produce a commendable paper.

- (v) When you have completed a topic, review the Learning Outcomes for the topic to confirm that you have achieved them and are able to do what is required.
- (vi) After completing all topics, review the Learning Outcomes of the course to see if you have achieved them.



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