Design and Implementation of Instructional Message Design for Online Learning in Postgraduate Programmes at Open University Malaysia

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Abstract

Open University Malaysia (OUM) has offered blended and online learning for almost 19 years since it was established in 2001. The long journey of providing the two modes of education has matured in offering online learning to learners. The learning process in an online learning environment is complicated for online learners due to the lengthy learning structure. Long learning structures affect online learners in terms of performing many tasks. A proper instructional strategy will make a meaningful learning structure with a significant task. The learning resources' design and development are considered part of the back-end process before the learning process. Some resources might not work due to a lack of pedagogical input during the design process. Message design with proper pedagogical strategies can be part of the activity in lesson design that contribute the information required by the learner to perform specific tasks. In performing the task, the learner tends to interact aggressively through the medium. The learner's cognitive ability for the learning resources is among the issues that need to be resolved. This study intends to determine an essential indicator in designing an interactive online learning prototype (IOLP). The development of an IOLP is based on the message design logic by Hullman (2004) and Petterson (2012). The task in IOLP is designed based on an adaptive learning approach. This study reports on the effects of the components in IOLP synthesised from Hullman (2004) and Petterson (2012) that are translated into the learning process embedded into appropriate pedagogical input. The analytic learning data from the Moodle-based Learning Management System report is used to measure the learner's cognitive ability on IOLP. The findings show that learners with more effort in performing the tasks laid out in IOLP will gain the highest score compared to those with less effort.

Keywords: *Message Design, Interactive Online Learning Prototype (IOLP), Pedagogy for Message Design*

Introduction

The learning process in an online learning environment is complicated for online learners due to the long and wide learning structure. An elongated learning structure will create many tasks to be performed by the learners. This situation leads to poor time management by online learners. A proper instructional strategy will result in a meaningful learning structure with a significant task.

Message design can be part of lesson design because it contributes the information required by the interpreter to perform specific tasks. In performing the tasks, learners tend to interact aggressively through the medium. The tasks can be organised into message design products through words, visuals, and forms, which are the main components of message design.

Regarding interaction or communication in message design products, Pettersson (2012) states that an originator, like an author, a designer, an illustrator or a painter, may want to tell somebody something. He or she has an "intended message" and one or more mental images to communicate. By creating a number of physical outlines or sketches, the originator can explain and demonstrate these mental images.

Communication barriers occur in message design products, primarily in computer-based education (CBE) learning packages. Most authors of CBE materials have not been exposed to the concepts of learning or instructional theory. David and Michael (1980) reported that review and computer-based instruction consistently identifies poorly designed, ineffective programs and packages.

Instructional resources should play a role in reducing the tasks performed by learners. These resources should also consider students' learning time (SLT) so that their understanding improves after they undergo the whole learning structure. The instructional resources, which include tasks, should also be packaged. The tasks should be minimal and flexible so as to reduce the procedures and activities required in digesting the content.

Kumar (2015) wrote that in the e-learning industry, "*time management is a difficult task for e-learners, as online courses require a lot of time and intensive work. Furthermore, whereas most adults prefer web-based learning programs for their place and time flexibility, they rarely have the time to take the courses due to their various everyday commitments*". Therefore, the amount of information in the online resources to be carried out by the learners in an online learning environment should be significant to support the *reuse of learning objects in a new instructional context* (Mohan, 2004).

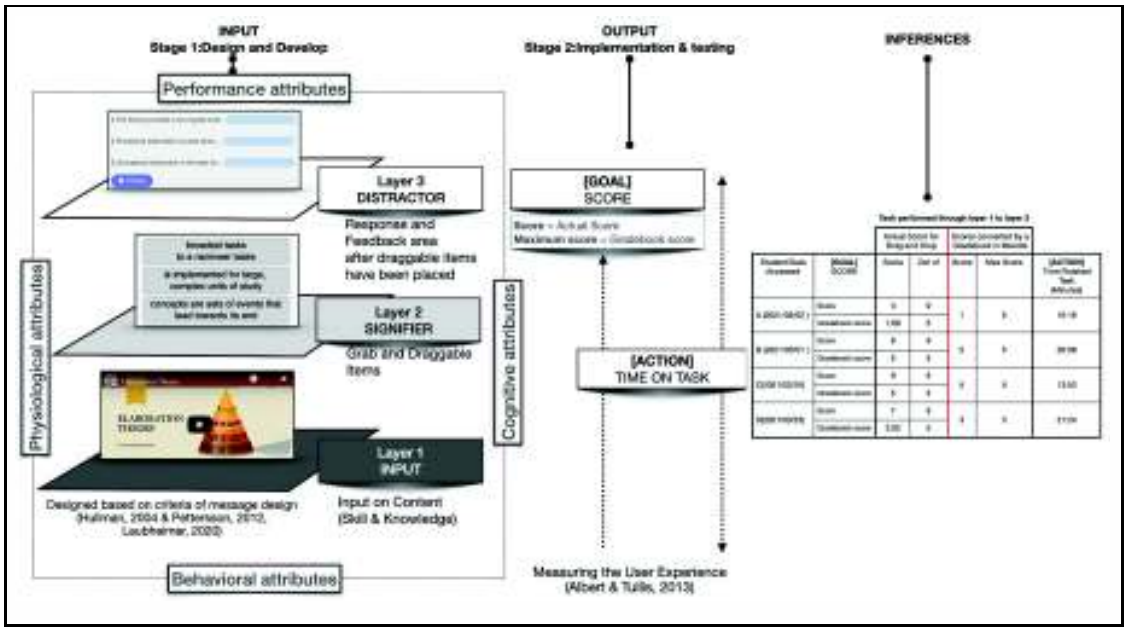
The quality of instructional message design relies on the design of the production process. Lack of application of the principles of learning and proper instructional design may lead to a defective product. David and Michael (1980) stated that the existence of instructional message design would not guarantee the production of quality CBE materials, and that the lack of exposure to principles of learning and instructional design can no longer be used as a general excuse for poor examples.

The new instructional context in this study refers to the compilation of or additional resources added to existing resources to reinforce learning. The Interactive Online Learning Prototype (IOLP) design includes layers of activities that are in line with the skill and knowledge provided in the existing resources.

IOLP is another attempt to observe the impact design of Drag and Drop activity on the learner's ACTION to achieve their learning GOAL. Figure 1 below shows the conceptual framework of the design of IOLP. The development of IOLP, which focuses on Drag and Drop activity, comprises three components. Each component functions as a TASK to be performed by learners. The learners need to go through the resource in Layer 1 and then complete Layer 2 (to react and respond to the items in SIGNIFIER and DISTRACTOR) to gain a SCORE.

Figure 1

IOLP Conceptual Framework



Research Objectives

The study's objective is to observe and examine learners' behaviour on the interactive online learning prototype (IOLP). The content is packaged and organised in the H5P plugin hosted in myINSPIRE, the Moodle learning management system at Open University Malaysia (OUM). The open educational resources (OER) content is remixed in interactive content, H5P, through the following content types: 1) drag the words and 2) mark the words.

The interactive content design is based on message design logic by Hulman (2004), which includes GOALS and ACTIONS by the creator and recipient. The content in the IOLP is analysed based on an adaptive learning approach. The IOLP is then tested on OUM postgraduate learners to observe their achievements (GOALS) and the time taken to achieve their goals (ACTIONS).

The design of the IOLP may impact the learning process of the postgraduate online learners in terms of their performance in achieving the specific learning objectives of certain topics. The findings may also provide an instructional designer with an indicator for an online interactive activity that can serve as part of the formative assessment for online learning.

Research Questions

1. What is the level of achievement (GOAL) within the learner's action time on task in IOLP?

2. To what extent is the learner's ability to achieve the maximum score within their time on task in IOLP?

3. What are the effects of drag and drop (drag the words) on the learner's score and time on the learner's task?

Literature Review

Message Design Defined

Several definitions related to the study are used to determine the scope of the study. In conveying the message from input to the signifiers and distractors in IOLP, one of the common factors that affect both input and the signifiers and distractors are the creator mental model and recipient mental model. The creator who designs the IOLP sets up the content knowledge through tasks and activities while the learners, as the recipients, perform the tasks and gain the rewards. In this case, Petterson (2012, p. 94) summarised a definition of message design as "*the message is information content conveyed from a sender to a receiver in a single context on one occasion".*

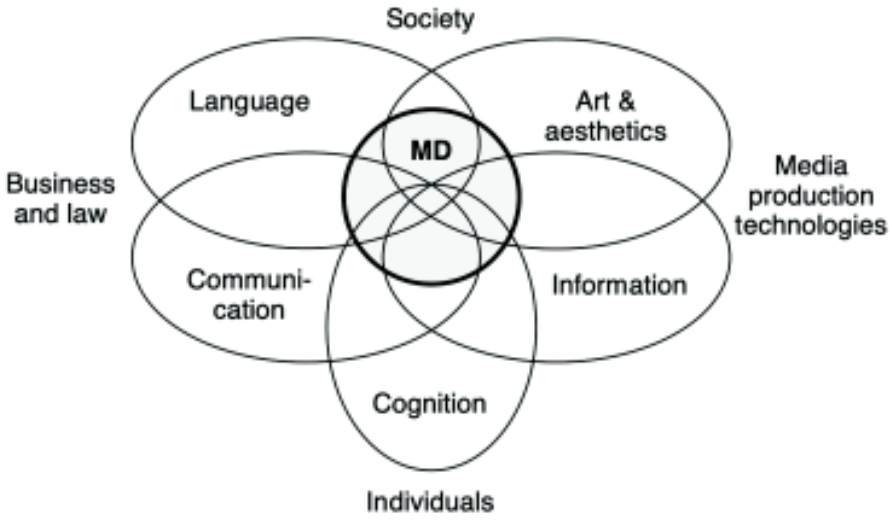
In context of teaching and learning, the term "message design" is very closely related to the formulation of instructional strategy in presenting the content to the learners. Seels (1996, p. 691) defined message design as planning for the physical form of the presentation part of an instructional strategy and the symbolic form in which a message is to be stored in memory.

Message Design Model

Figure 2 shows the components of message design by Pettersson (2012, p. 94) who stated that *the main components in message design are words, visuals, and forms. These main components may be used in many different ways to design, produce, transmit, and interpret messages. Depending on the different objectives of messages, we can see five different groups comprising: 1) graphic design, 2) information design, 3) instruction design, 4) mass design, and 5) persuasion design*. Concerning the design process and teaching and learning, generally, the components contribute to the design aspects. On the whole, the components may give insight to the developer in determining the criteria of the product's design.

Figure 2

Message Design (MD) is Interdisciplinary and Encompasses Influences and Facts from Many Established Disciplines (Pettersson, 2012, p. 95)



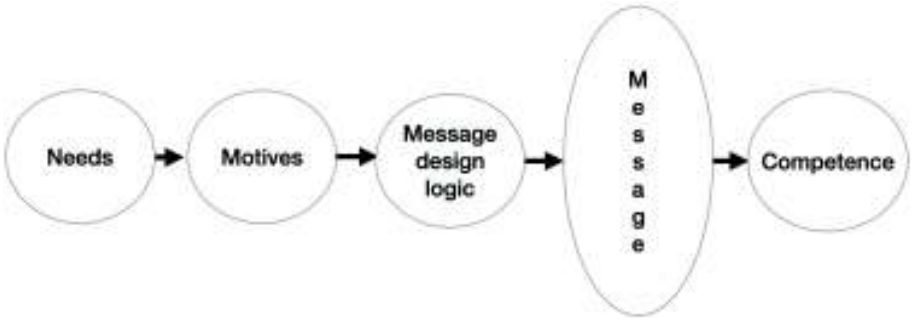
In the context of this study, instructional message design intends to observe the component of the message design logic in the IOLP. The number of signifiers and distractors in IOLP will affect the organisation of tasks, hence, allowing us to determine the competency level of the learner. To achieve the objectives, the design of the IOLP should include the goals and needs of the communication to the learner.

Message Design Logic

Hullman (2004) supported Spitzberg and Cupach (1984) and Rubin (1990) who stated that goals are designed as means to an end. The end is **motive** fulfillment, which is represented by **competence** (see Figure 3). Competence comprised both effectiveness and appropriateness (Rubin, 1990; Spitzberg & Cupach, 1984). **Effectiveness** refers to the extent to which communication accomplishes its goal, while appropriateness refers to how the communication fulfils others' expectations about what is suitable communication for the situation.

Figure 3

Motives Model with Message Design Logic as Goal Step (Hullman, 2004 p. 210)



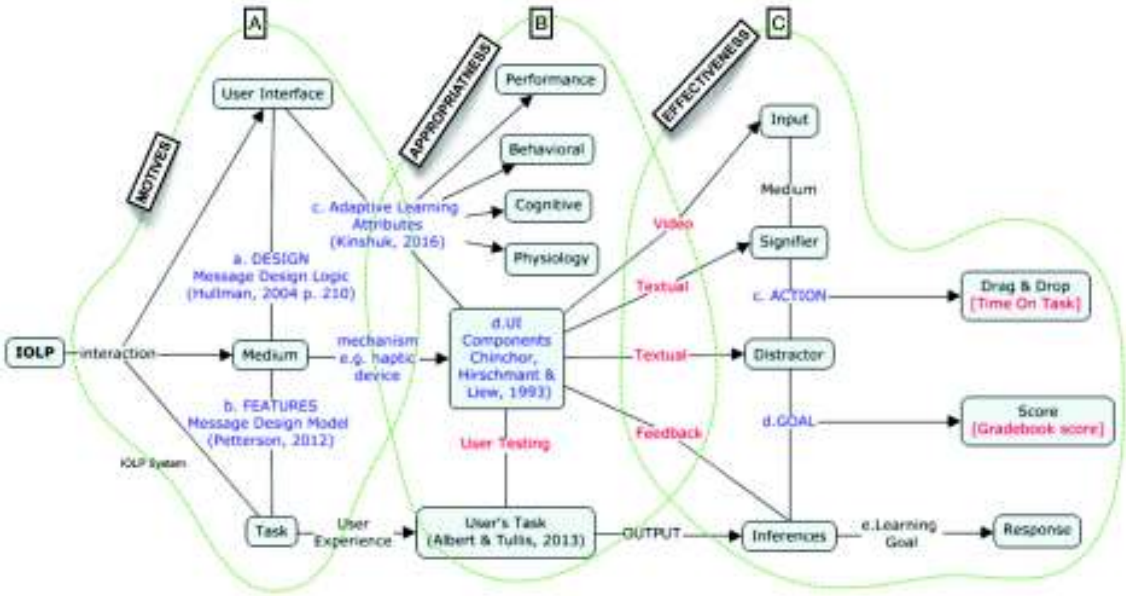
IOLP Design Principle

The design of IOLP should be made coherent from each section between three main components in the IOLP system. Beyer and Holtzblatt (1998, p. 296) stated that when the system work model is coherent, it keeps the user's work coherent; when it fragments, it is the user's work that is disrupted.

For IOLP, message design logic seems to be one of the profound components embedded in the IOLP system. Figure 4 shows the components of the IOLP system. It comprises three main components: A, B, and C, which embed the message design logic (Hulman, 2004), including motives, appropriateness, and effectiveness. Component A comprises three central systems that work for hands in hands, the user interfaces, the medium, and the task. Component B reflects the operation by the learner on the user interface, the medium to fulfil the task. Meanwhile, Component C demonstrates the suitability of communication in accomplishing its goal.

Figure 4

IOLP System



Instructional Message Design and Adaptive Learning

The online learning environment reinforces the connection between the learner and the content through learner-learner or learner-teacher interaction. Providing content online enables the learner to be more autonomous. According to Wang and Shen (2012, p. 563), in formal learning environments, the convenience provided by mobile technologies strengthens the link between the learner and the content which, in behaviourism terms, is described as "stimulus and response."

The complexity of interactive online learning relies on the organisation and number of tasks that may impact the learner's cognitive load. The simplification of tasks can be made considering the three main components, i.e., motives, appropriateness, and effectiveness on message design, as illustrated in Figure 4. The input, signifiers, and distractors as the UI components through the drag and drop application enable learners to reduce user tasks, for example, typing. They can focus on thinking rather than spending time "typing" the answer. Van Merrienboer (1997) in Van Gog et. al. (2010, p. 312) stated that given the high cognitive load imposed by such tasks, they should be offered in such a way that learners are not cognitively overloaded by their complexity. That is, learners should be given the opportunity to practise simplified but increasingly complex versions of authentic whole tasks.

Once the link is made clear between learner and content, an appropriate instructional message design such as IOLP will give more options to the learner to create a learning path and be more independent. This situation will lead to the application of an adaptive and personalised learning environment. Kinshuk (2016, p. 43) stated that such an environment strives to support the learning process of students by understanding their competency in the subject matter and their personal ability to learn. One of the important characteristics that adaptive and personalised learning environments take into account is the cognitive abilities of students.

The assimilation of an adaptive and personalised learning environment may affect the IOLP system in terms of the user interface design (UID), which will affect the user's task. The task can be clearly defined through adaptive learning attributes, as illustrated in Table 1.

Table 1

Adaptive Learning Attributes (Kinshuk, 2016, p. 10)

Attributes	Descriptions
Performance attributes	These attributes are related to the students' competency in the subject matter, such as the level of the student's current understanding of the domain content, his/her experiences within the domain, and competency in domain-related skills
Behavioral attributes	These include various characteristics related to the students' personal behaviours, such as the preferences of the student, familiarity with the exploration process, and familiarity with various types of multimedia objects.
Cognitive attributes	These attributes are related to the students' cognitive load capacity. They require understanding of the students' cognitive abilities.
Physiological attributes	These attributes are related to the student's physical state. They can be analysed by measuring various physical parameters.

Research Method

Introduction

This study was based on the design and development of a message design system called the IOLP, proposed by Pettersson (2012) and Hullman (2004), and the adaptive learning attributes proposed by Kinshuk (2016). The IOLP test is based on Albert and Tullis (2013).

The study involves two stages. Stage one consists of the design of the IOLP by organising OER content in the open-source authoring tool, H5P. Stage two consists of testing whereby six students enrolled in the Master of Instructional Design and Technology programme at OUM are required to perform the tasks in the IOLP.

Functions and Features of Message Design in Context of IOLP

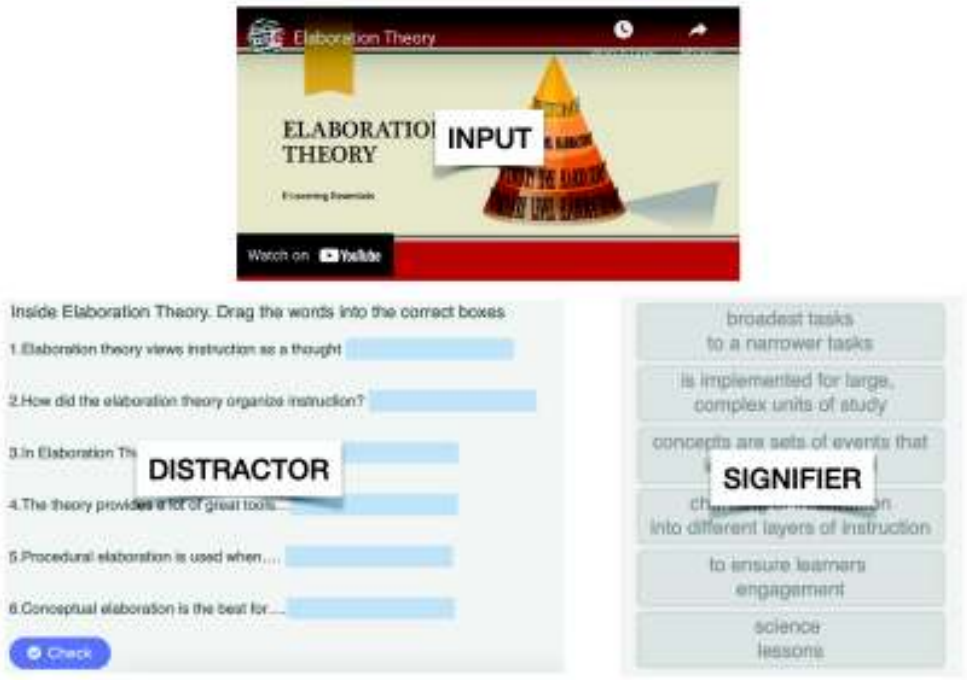
The user interface design (UID) of the IOLP is based on the design provided in H5P which followed the main principles by Chinchor et al., (1993) as follows:

- Functional principles: This group includes six principles: 1) defining the problem, 2) providing structure, 3) providing clarity, 4) providing simplicity, 5) providing emphasis, and 6) providing unity.

- Administrative principles: This group includes four principles: 1) information access, 2) information costs, 3) information ethics, and 4) securing quality.

Figure 5

TASK 2.1: Behaviourism, Cognitivism, Constructivism and Learning and Instruction



Nature of Drag and Drop System

Generally, the nature of any type of message design should consider the following properties:

1. Aesthetic principles which include harmony and aesthetic proportion.

2. Expressive design logic reflects reactivity: A person responds to a prior message instead of focusing on goals relevant to the situation (Hullman, 2004, p. 209).

3. Cognitive principles which include facilitating attention, perception, processing, and memory (Petterson, 2012).

These three properties will enable the user to perform the task effectively by responding explicitly to the items in the signifier and gain a result of the execution of the functions.

A "signifier" is some sort of indicator, some signal in the physical or social world that can be interpreted meaningfully (jnd.org, 2018). *A drag-and-drop signifier has to signal two functions – (1) that the item is "grabbable" and (2) what dragging it somewhere will accomplish (moving or resizing) (Laubheimer, 2020). Clear signifiers and clear feedback at all stages of the interaction make drag and drop discoverable and easy to use (Laubheimer, 2020)*.

The application enables the user to organise the signifier in terms of user interface design (UID) in the drag and drop system. However, in an application such as H5P, the signifier and distractor are fixed.

Findings

Figure 6 shows the number of signifiers and distractors and the range of time for input in UID provided in Tasks 2.1 and 3.1. User interface design elements in Task 2.1 have YouTube video (input) with a presentation time of 2.58 minutes followed by nine signifiers and distractors as drag and drop elements. In comparison, Task 3.1 has YouTube video (input) with a presentation time of 4.40 minutes followed by six signifiers and distractors as drag and drop features.

Figure 6

Numbers of Signifiers and Distractors and Range of Time for Input in UID for Tasks 2.1 and 3.1

User Interface	Input (YouTube Video)	Signifier	Distractor
Task 2.1	 Presentation: 2.58 min	9	9
Task 3.1	 Presentation: 4.40 min	6	6

Research Question 1. What is the level of achievement (GOAL) within the learners' action time on task in IOLP?

Figure 7 shows the learner's performance on the task laid out in Figure 8. For user interface (UI) Task 2.1, two students, student C (sC, score 5, time on task = 20 min) and student B (sB score 5, time on task = 20 min), achieved the highest score of 5 out of 9. Both students completed the task at the same time. Student D achieved a score of 3 out of 7 with 21 minutes on time on task. Even though the achievement score is 3 out of 7, student D has shown effort in performing the task with 21 minutes on the task. Meanwhile, student A achieved a score of 1 out of 3 with 10 minutes on task, which shows less effort in performing the task.

Figure 7

TASK 2.1 – Behaviourism, Cognitivism, Constructivism and Learning and Instruction

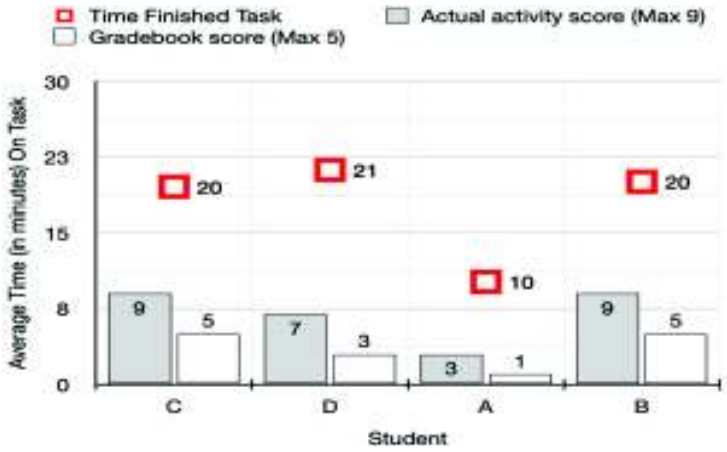


Figure 8

User Interface (UI) TASK 2.1: Behaviourism, Cognitivism, Constructivism and Learning and Instruction

Video Source: LearningDctr. (Jun 17, 2010). Behaviorism, Cognitivism, Constructivism & Learning and Instructional Theory [Video]. Website host. URL https://youtu.be/0YOqgXjynd0

Figure 9 shows the learner's performance on the task laid out in Figure 10. For user interface activity 3.1, Students A, B, and C achieved the highest scores, 5 out of 6. Students A and C achieved 20 minutes on task while Student B achieved only 5 minutes. Student D achieved a score of 3 out of 4 with 21 minutes on the task.

The findings show students who achieved the highest scores performed the task in 20 minutes. However, there is a tendency for the students to perform better; for example, the student with the highest score completed the task in 5 minutes. On the other hand, one student with the lowest score of 3 out of 4 spent 21 minutes on the task.

Figure 9

ACTIVITY 3.1: Elaboration Theory by Reigeluth

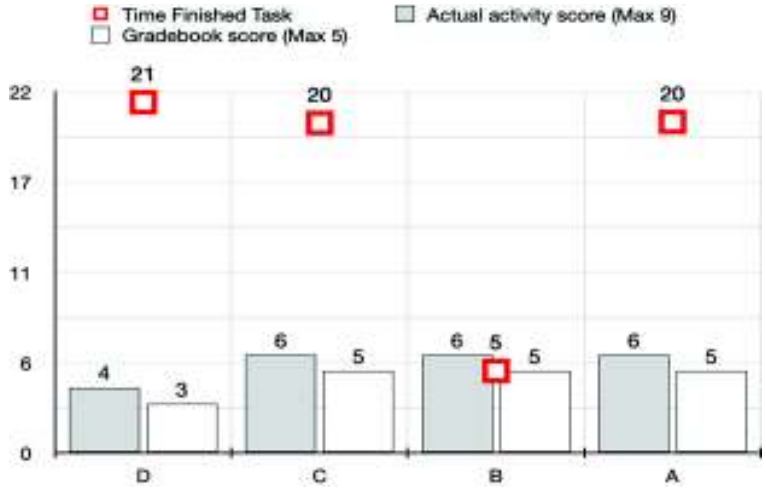


Figure 10

User Interface ACTIVITY 3.1: Elaboration Theory by Reigeluth

Research Question 2. To what extent is the learner's ability to achieve the maximum score within the time on task in IOLP?

Table 2 shows the effects of response on the signifier to the distractors after performing the task within the time on task in Task 2.1. In Figure 10, the green signifier on distractors represents the correct response, while the red signifier on distractors represents an incorrect response. Students B (sB) and C (sC), who gained the highest scores of 5 out of 5 with 20 minutes on task, show a high thinking ability in understanding the contents presented in the video (as input). In contrast, student D (sD), with 21 minutes on task, still lacks understanding of the content of the video (input), with only seven correct signifiers on the distractors. Student A (sA) who spent only 10 minutes on a task shows two correct responses for the signifier on the distractors.

Table 2

Distribution of Scores on Goal and Action for Task 2.1

	GOAL		Time on Task: ACTION
User	Score	Max Score	Finished (Minutes)
sC	5	5	2021/04/12 – 19:58
sD	3	5	2021/03/23 – 21:24
sA	1	5	2021/03/02 – 10:16
sB	5	5	2021/03/01 – 20:08

Figure 11

TASK 2.1: Behaviourism, Cognitivism, Constructivism and Learning and Instruction

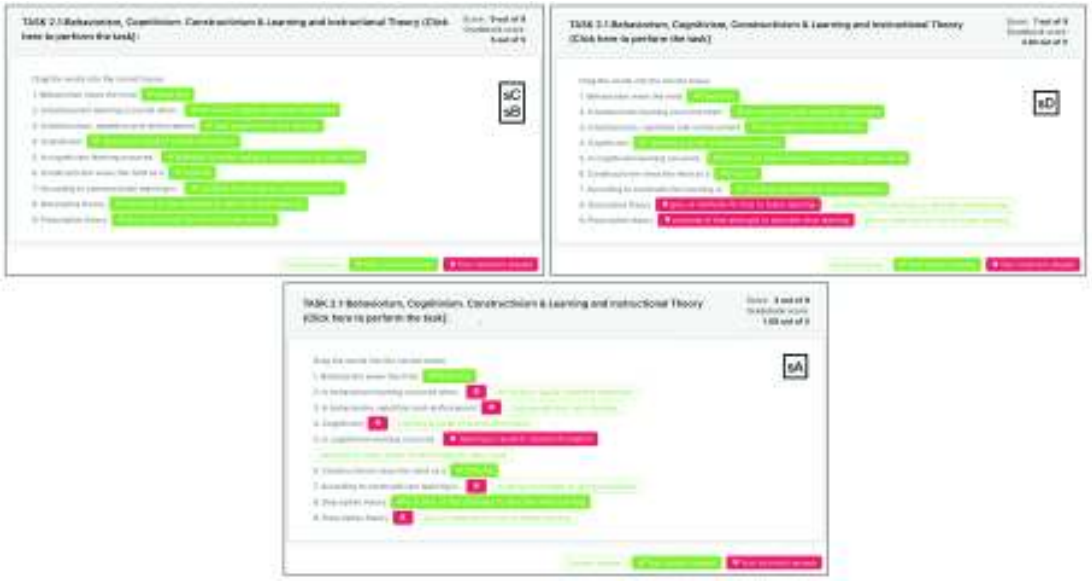


Table 3 and Figure 11 show the effects of response on the signifier to the distractors after performing the task within the time on task in Activity 3.1. The findings show that Students A (sA), B (sB), and C (sC) have demonstrated their abilities in providing a correct response on the signifier to the distractors. However, amazingly, Student B (sB) managed to complete the task in 5 minutes and achieve the highest score, compared to Students A and C. Meanwhile, Student D(sD), could respond to four correct signifiers on the distractors in 21 minutes on the task.

Table 3

Distribution of Scores on Goal and Action for Task 3.1

	GOAL		Time on Task: ACTION
User	Score	Max Score	Finished (Minutes)
sA	5	5	2021/04/12 – 20:11
sC	5	5	2021/03/26 – 20:17
sD	3	5	2021/03/23 – 21:37
sB	5	5	2021/02/14 – 05:01

Figure 12

ACTIVITY 3.1: Elaboration Theory by Reigeluth

Research Question 3. What are the effects of drag and drop (Drag the words) on the learner's score (Goal) and time on the learners' task (Action)?

Time on task is simply the time elapsed between the start and end of a task, usually expressed in minutes and seconds. Logistically, time on task can be measured in many different ways (Albert & Tullis, 2013, p. 75). Ux Collective (n.d.) stated the approach of drag and dropped as the following:

- Drop targets are areas that visually indicate where elements can be dropped.
- Natural movement drag and drop is when other elements move naturally out of the dragged elements.

The UID for drag and drop is set up based on three essential components: input, signifiers, and distractors. Students need to go through the input (video) and digest the information before dragging the signifier on the right distractors. The *start task* (Albert & Tullis, 2013) that portray *natural movement drag and drop* (Ux Collective, n.d.) represent **Goal**. Table 4 shows the distribution of scores on goal and action for Tasks 2.1. and 3.1. The findings show two UID representing two scenarios to fit in the ideas on the *end task* (Albert & Tullis, 2013) that describe the *drop target* (Ux Collective, n.d.) representing action. The two scenarios are built to determine the effects of drag and drop on the learners' goal and action.

Table 4

Distribution of Scores on Goal and Action for Tasks 2.1 and 3.1

		GOAL		Time on Task: ACTION
	User	Score	Max Score	Finished (Minutes)
Scenario 1 Task 2.1	sC	5	5	19.58
	sD	3	5	21.24
	sA	1	5	10.16
	sB	5	5	20.08
	Average	3.5		17.77
Scenario 2 Task 3.1	sA	5	5	20.11
	sC	5	5	20.17
	sD	3	5	21.37
	sB	5	5	5.01
	Average	4.5		16.67

Table 5 shows the Average Mean (M) Goal and Action for Task 2.1 (Scenario 1) and Task 3.1 (Scenario 2). The results are discussed in Table 6.

Table 5

Average Mean (M) on Goal and Action for Task 2.1 (Scenario 1) and Task 3.1 (Scenario 2)

Scenario	Criteria for Measurement	Goal and Time on Task (Albert & Tullis, 2013)	Result
		Scenario 1	
	Start Task (Albert & Tullis, 2013) Natural movement drag and drop (Ux Collective, n.d.)	**Goal**	(*M* = 3.5)
		Time on task: ACTION	(*M* = 17.77)
		Scenario 2	
	End Task (Albert & Tullis, 2013) Drop targets (Ux Collective, n.d.)	**Goal**	(*M* = 4.5)
		Time on task: ACTION	(*M* = 16.67)

Inference is based on **Score** (GOAL) and **Finished** (Time on Task – **ACTION**) as discussed in Table 6.

Table 6

Result on Goal and Action Based on the Input, Signifiers, and Distractors

User Interface	Input (YouTube Video)	Signifier	Distractor	Results
Task 2.1	Presentation: 2.58 min	9	9	1. More signifiers and distractors will affect the time on task of the learners.
Task 3.1	Presentation: 4.40 min	6	6	2. The learners will perform better with more range of time of learning in input with fewer signifiers and distractors (for drag and drop activities)

Discussion

The findings yield three important factors that need to be considered in designing the IOLP:

1. The findings show that students with the highest scores (sB and sC) have demonstrated their efforts in performing the task. The student with the lower score (sD) also has shown effort in completing the task. Therefore, the student with less effort in performing the task would not be able to get a good score. The findings are in line with applying adaptive learning attributes in the user interface design that affect the user's task (Kinshuk, 2016).

2. The findings show that students will perform better if they are willing to spend more time going through the input (video) before explicitly reacting to the signifier on the distractors. Some students with high thinking skills may perform better in a shorter time. However, they also need more time to complete the task.

3. The findings show the learners scored lower (M = 3.5) and took a longer time in performing the task in scenario 1, which contained nine signifiers and distractors and 2.58 minutes of YouTube video as input. The learners scored better (M = 4.5) and took less time in performing the task in scenario 2, which contained nine signifiers and distractors and 4.40 minutes of YouTube video as input. This shows the importance of the three main components, i.e., motives, appropriateness, and effectiveness of message design logic in the IOLP system which will reduce the cognitive overload, as stated by Van Merrienboer (1997) in Van Gog et al. (2010).

Conclusion

Based on the message design model and logic, the study examined the learner's behaviour on an IOLP. The application of the message design model and logic in the IOLP was translated into tasks with three components: input, signifiers, and distractors. The tasks were then measured through the user's task (ACTION) to observe their GOAL. The design and development of the IOLP was based on the message design model by Pettersson (2012) and Hullman (2004) and the adaptive learning attributes by Kinshuk (2016). The IOLP test was based on Albert and Tullis (2013). The findings will benefit postgraduate online learners in building better understanding of certain concepts without the help of their lecturer. Even without a lecturer, the student who put in more effort in performing a task in the input gained the highest score, compared to learners who made less effort. Adapting the ideas in the design process leads to creating an IOLP system that will also benefit instructional designers in designing self-instructional materials for online learning. The findings will also help instructional designers to explore interactive online learning packages, specifically drag-and-drop applications. This is a small study on conducting user testing on the IOLP for online learning. More analysis is needed on a large sample of respondents on the effects of the content type in H5P on the learner's performance and learning time.

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