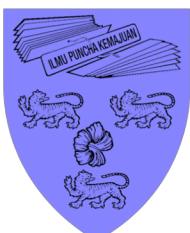




Classification of Learning Object based on Personalization

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19 JAN 2020

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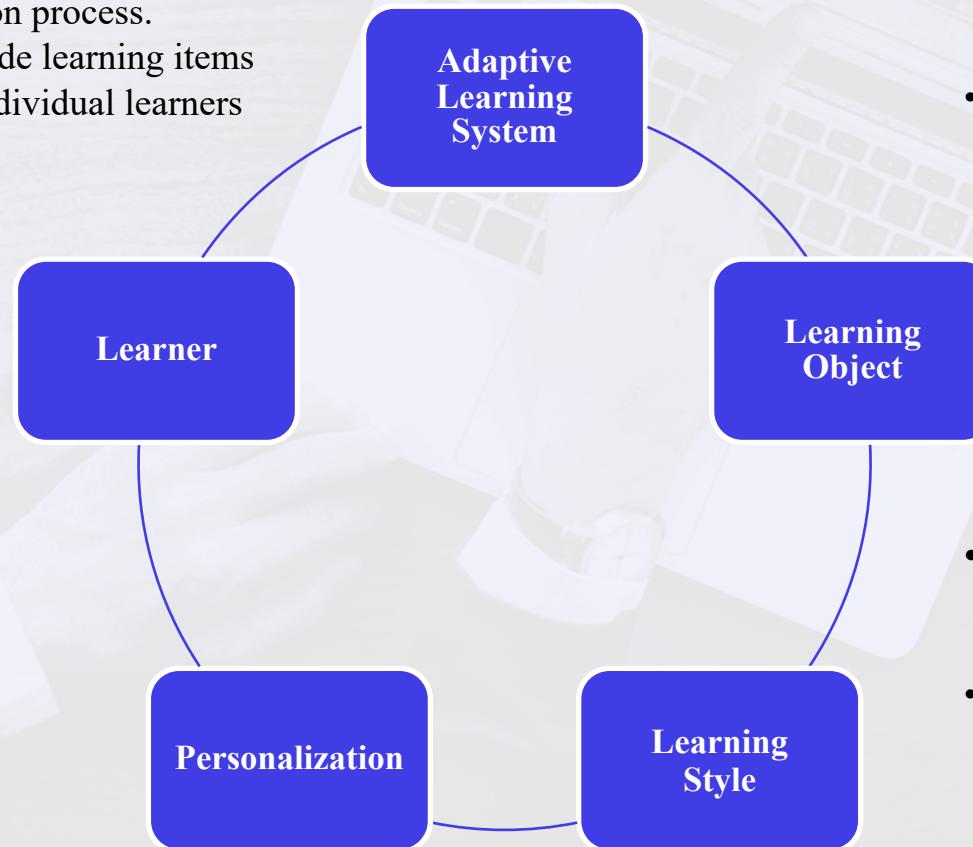


Introduction

- Learning can be enhanced through the presentation of materials that are consistent with a student's particular learning style (*Pen˜a, Marzo, & Rosa, 2002; Stash, Cristea, & Brau, 2004, Normadhi et al., 2020*).
- Learning Style (LS) is important in a learning process. It can help students enhance their learning capabilities. For example, if educators know and understand student's LS, they can proposed the suitable learning object that is suited to students' LS, which can assist the students in understanding the subject better and enhance their learning capabilities (*Mestre, 2010*).
- Educators tend to provide various types of learning objects to cater difference type of learning style preference.
- The learning style of a learner is uniquely identified based on how a learner is getting and processing the information (*John & Maria, 2019*).
- In the process of recommending learning objects to students, this study will be helpful to identify which learning objects belong to which students personalization preference.

Introduction

- **Adaptive Learning System** is a tool for transforming the learning system from a passive reception of information by the receiver to an interactive process by collaborating in the education process.
- Adaptive learning systems aim to provide learning items tailored to the behavior and needs of individual learners (*Pliakos et al., 2019*)
- A **learner** is a person who is still learning something. The process of learning by the learners is continuously
- **Personalization** in learning is an educational approach that aims to customize learning for each student's strengths, needs, skills and interests.

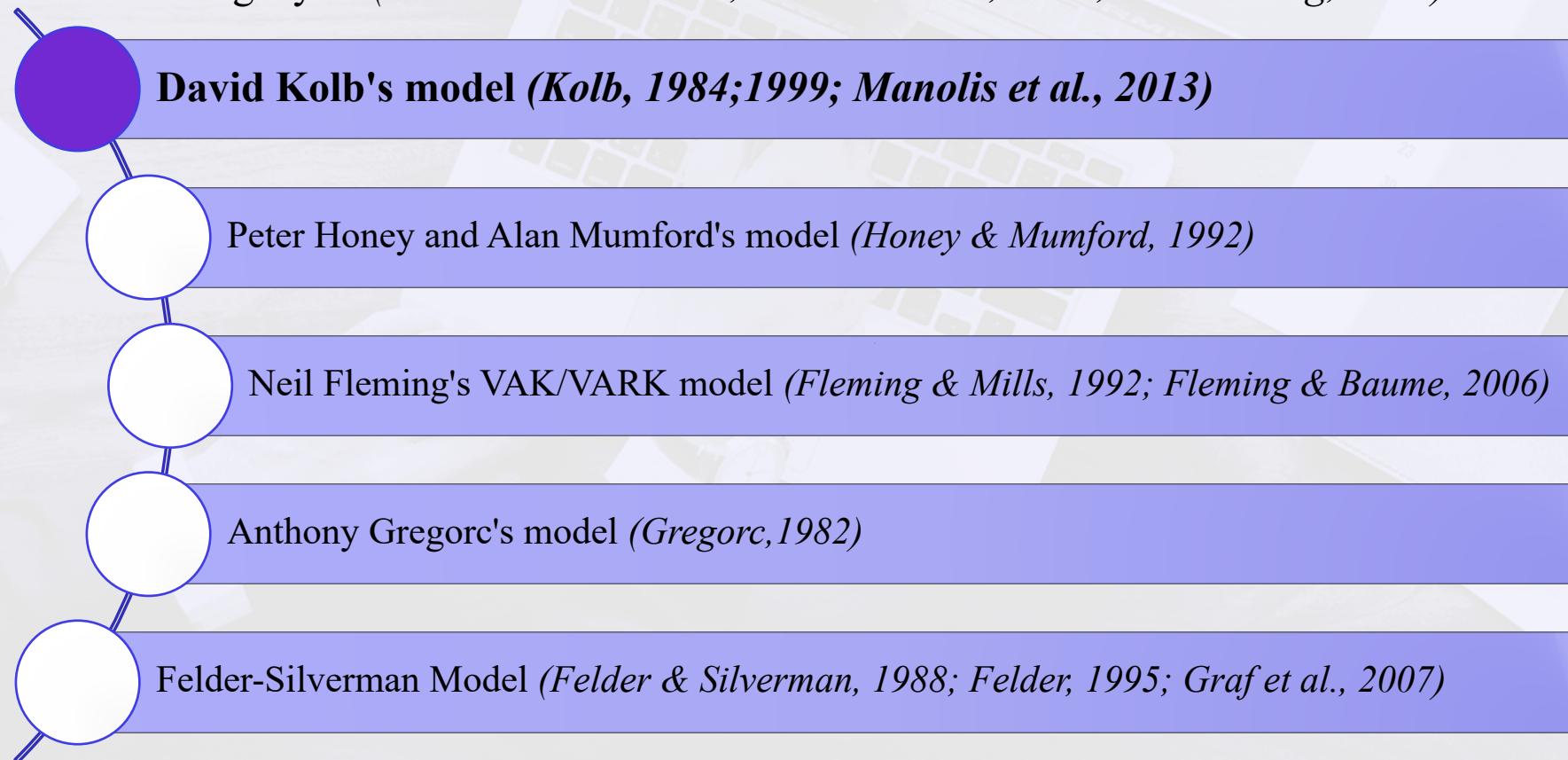


- Any digital entity; a text, a movie, an animation, an instructional content, etc., or a composition of these bodies into larger objects, with defined educational purpose (*Scudelari de Macedo, & Ribas Ulbricht, 2012*).
- Can be located and reused, either alone or in the composition of larger objects, with defined goals and educational strategies, in different educational contexts (*Scudelari de Macedo, & Ribas Ulbricht, 2012*).
- **Learning styles** which refer to students' preferred ways to learn can play an important role in adaptive e-learning systems (*Truong, 2016*).
- It refers to the preferential way in which the student perceives, processes, understands and retains information (*El Aissaoui et al., 2019*).

Introduction

- There are numerous LS Model in literature.
- In this study we used Kolb's LS Inventory. This is because, the model is one of the most widely used, influential and researched models of learning styles (*D'Amore et al. 2012; Manolis et al., 2013; Liu & Wang, 2020*)

Learning Style Model



Introduction

David Kolb's Learning Style Models:

- Problem Kolb's LS Inventory is based on the Experiential Learning Theory (Kolb, 1984;1999). His model outlined two levels. The first level is a four-stage cycle which is Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC) and Active Experimentation (AE).
- The second level represents the combinations of two preferred stages as illustrated in Figure.

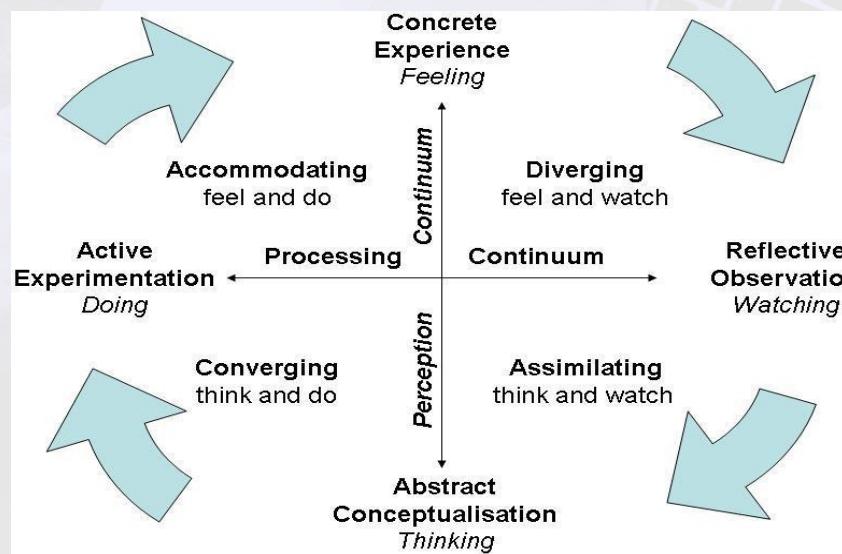


Figure 1: Kolb's Learning Style

Introduction

Relationship between Learning Object/Teaching Strategy and Learning Style

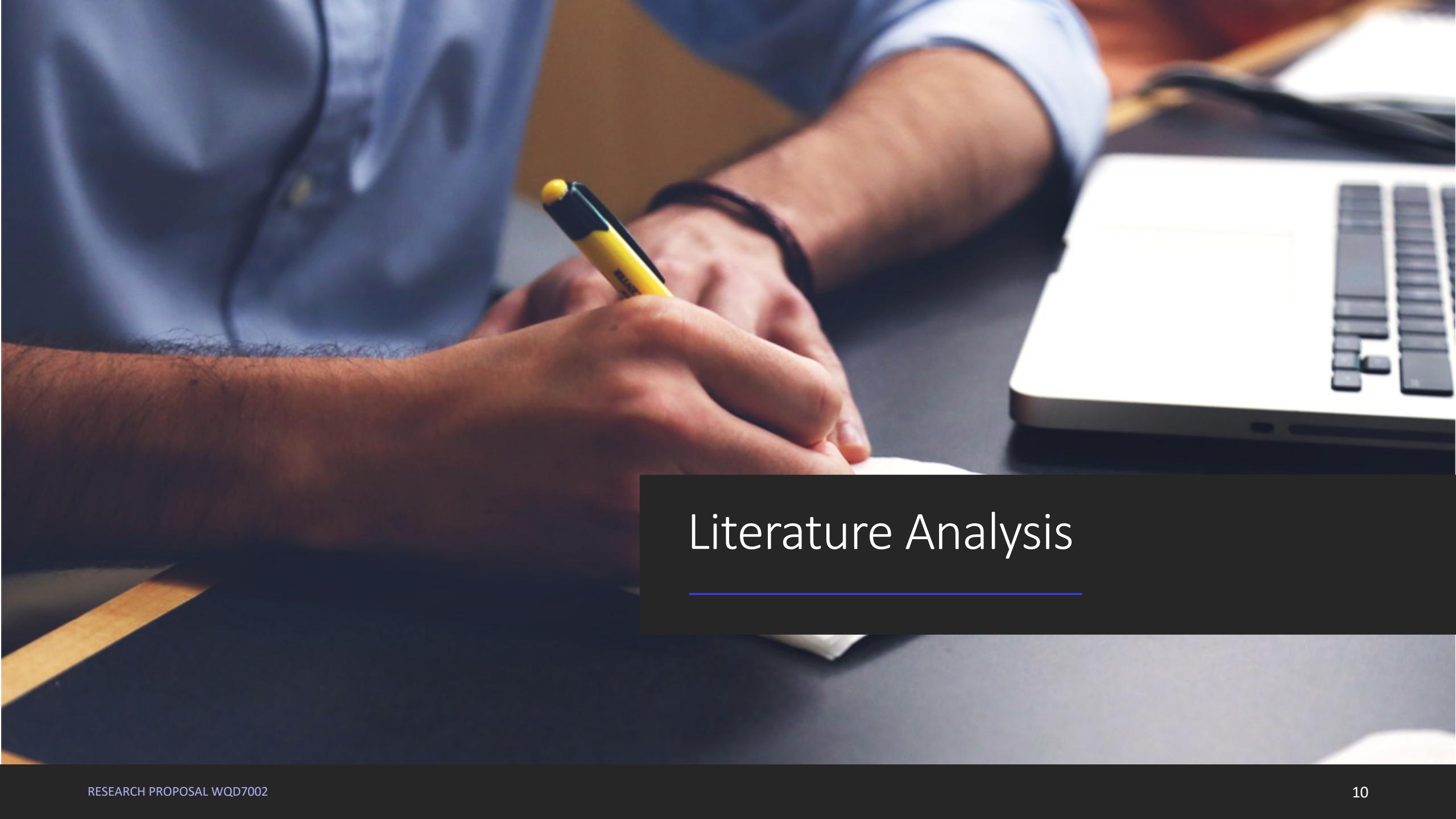
- Students learn more effectively when the learning object used is matched with their individual learning styles (*Haq & Chand, 2012; León, Peñalvo, & Conde, 2007; Rasmussen, 1998*).
- *Mestre (2010)* reported that by linking learning object and learning style, students can take in and interact with information more effectively.
- Educators are also encouraged to teach students based on students' learning style (*Hsieh, Mache, & Knudson, 2012*).
- *Tulbure (2011)* studied the relationship between teaching strategies and learning styles and found out that student with different learning style respond differently to different teaching strategy.
- Learning Style (LS) is important in a learning process. It can help students enhance their learning capabilities. For example, if educators know and understand student's LS, they can proposed the suitable learning object or teaching strategies that is suited to students' LS, which can assist the students in understanding the subject better and enhance their learning capabilities (*Mestre, 2010*).
- An interesting paper by John et al. suggest to consider the individual characteristics of learner that is recommendation and personalization of learning objects have to be addressed since the efforts made by the system in designing the course and the learning object are still unsatisfied (*John & Maria, 2019*).

Problem Statement

- Most of the researchers classify the learning objects based on the description of learning style preference itself. A paper by Fleming described learning styles as individuals' characteristics and preferred ways of gathering, organizing, and thinking about information (*Fleming, 2005*).
- Moreover, there is lack of considering students' feedback in previous researches. The feedback of the students should be considered in the evaluation process to let us allocate more appropriate learning objects to students (*Shuib, 2013; Balasubramanian & Anouncia, 2018; Nurasma' & Jasber, 2020*).
- This research proposed a classification of learning objects based on students' personalization.

Research Objectives & Research Questions

RO1	To develop a classification model of learning object based on personalization
RQ1	How should the classification model of learning object based on personalization be developed?
RO2	To evaluate the model performance of learning object based on personalization
RQ2	What is the performance of classification model that being developed?

A close-up photograph of a person's hands writing in a notebook with a yellow pen. The person is wearing a blue shirt and a black watch. In the background, a laptop is open, showing its keyboard. The scene suggests a professional or academic setting.

Literature Analysis

Literature Analysis

Reference	Approach	Learning Style Model	Learning Object	Limitations
Buckley & Elaine, 2017	Adaptive Learning	FSLSM	Gamified Learning Intervention	<ul style="list-style-type: none">• Gamification should to be seen as a specific tool in the teaching, learning and assessment toolkit, and used as part of a holistic instructional design process
Shuib, 2013	Adaptive Learning	VARK	Text	<ul style="list-style-type: none">• Feature Extraction Algorithm cannot extract vector images, symbols and size of image from PDF document• Sample size for the experiment• Not considering students' feedback
Biabani & Izadpanah, 2019	Adaptive Education	Kolb LSM		<ul style="list-style-type: none">• A comprehensive study needed to be done on students from different years of studying English as a foreign language in order to provide more generalisable results
Ramírez-Correa et al., 2017	Adaptive e-learning	FSLSM		<ul style="list-style-type: none">• This study's major limitation is the use of a non-random sampling method. People should be chosen from different organizations
Gebru et al., 2015	Adaptive Learning	Kold LSM		<ul style="list-style-type: none">• Larger Sample should be used• Gender should be considered

Literature Analysis

Reference	Approach	Learning Style Model	Learning Object	Limitations
Crockett et al., 2017	Adaptive Learning	FSLSM	-	<ul style="list-style-type: none">• further experiments would be needed using different and more learners
Stirling et al., 2017	Adaptive Suggestion	VARK		<ul style="list-style-type: none">• Any relationships between learning style preference and academic performance should be assessed
Chun et al., 2014	Adaptive Learning	FSLSM	Game-based Learning Material	<ul style="list-style-type: none">• Lack of collaborative learning via network communications• Time constraints to collect more detailed behavioral information• Limited sample size
Bernard et al. 2015	Adaptive Learning	FSLSM	-	<ul style="list-style-type: none">• Using hybrid artificial intelligence/computational intelligence approaches for learning style identification should be used
Essalmi et al., 2015	Adaptive E-Learning	FSLSM	Hypermedia	<ul style="list-style-type: none">• Lack of having feedback about additional constraints to consider• Using different personalization strategies

Research Methodology



Research Methodology

Problem Identification

Data Collection

Data Pre-Processing

Model Development

Model Evaluation

- Undergraduate and Postgraduate Students
- A survey which will be conducted based on Kolb's LS model to get students' preference in learning object based on their personalization
- Data Cleaning
- Machine Learning Approach—Classification Model

Research Methodology

Problem Identification

- The research problem is identified by reviewing previous work through literature analysis related learning object, the concept of learning style, personalization, machine learning and information extraction by comparing all of the previous works.

Research Methodology

Data Collection

- Data collection will be done through a survey which will be conducted based on Kolb's LS model to get students' preference in learning object based on their personalization



Curate Survey Questions

- Qualitative Findings
- Literature Review
- Additional Questions Components to solve limitations



Part I: Personal Details

Please select the appropriate response for each question.

Gender *

Male

Female

Level of Study *

Undergraduate

Postgraduate

Institutions *

Your answer

Faculty *

Data Pre-Processing

- Data cleaning will be applied to the dataset to handle missing values and ambiguous results. Due to the nature of survey questionnaire, many transcription errors will be detected in the dataset and will be managed accordingly.
- Feature selection method plays an important role to ensure only attribute that contribute the most to the prediction will be selected.
- The irrelevant attributes which are not important for the study (such as name, ID, requesting Dr) will be removed.
- Others will be filtered accordingly using Principle Component Analysis (PCA) and Pearson's Chi square before the classification of the learning object.

Research Methodology

Model Development

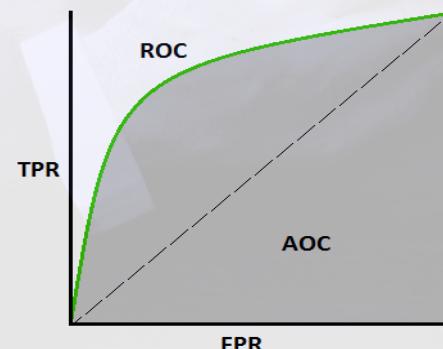
- To identify which machine learning method such as SVM, Naïve Bayes, kNN or Decision Trees are the best at performing learning object classification.



Research Methodology

Model Evaluation

- Confusion Matrix:
 - Accuracy (The proportion of the predictions that were correct)
 - Sensitivity (The proportion of the actual positive cases that were correctly identified)
 - Specificity (The proportion of the actual negative cases that were correctly identified)
- Area Under Curve (AUC) - Derived from summary measure of accuracy from ROC curve



$$\text{TPR or Sensitivity} = \frac{\text{TP}}{\text{TP} + \text{FN}}$$

$$\text{FPR or Specificity} = \frac{\text{TN}}{\text{TN} + \text{FP}}$$

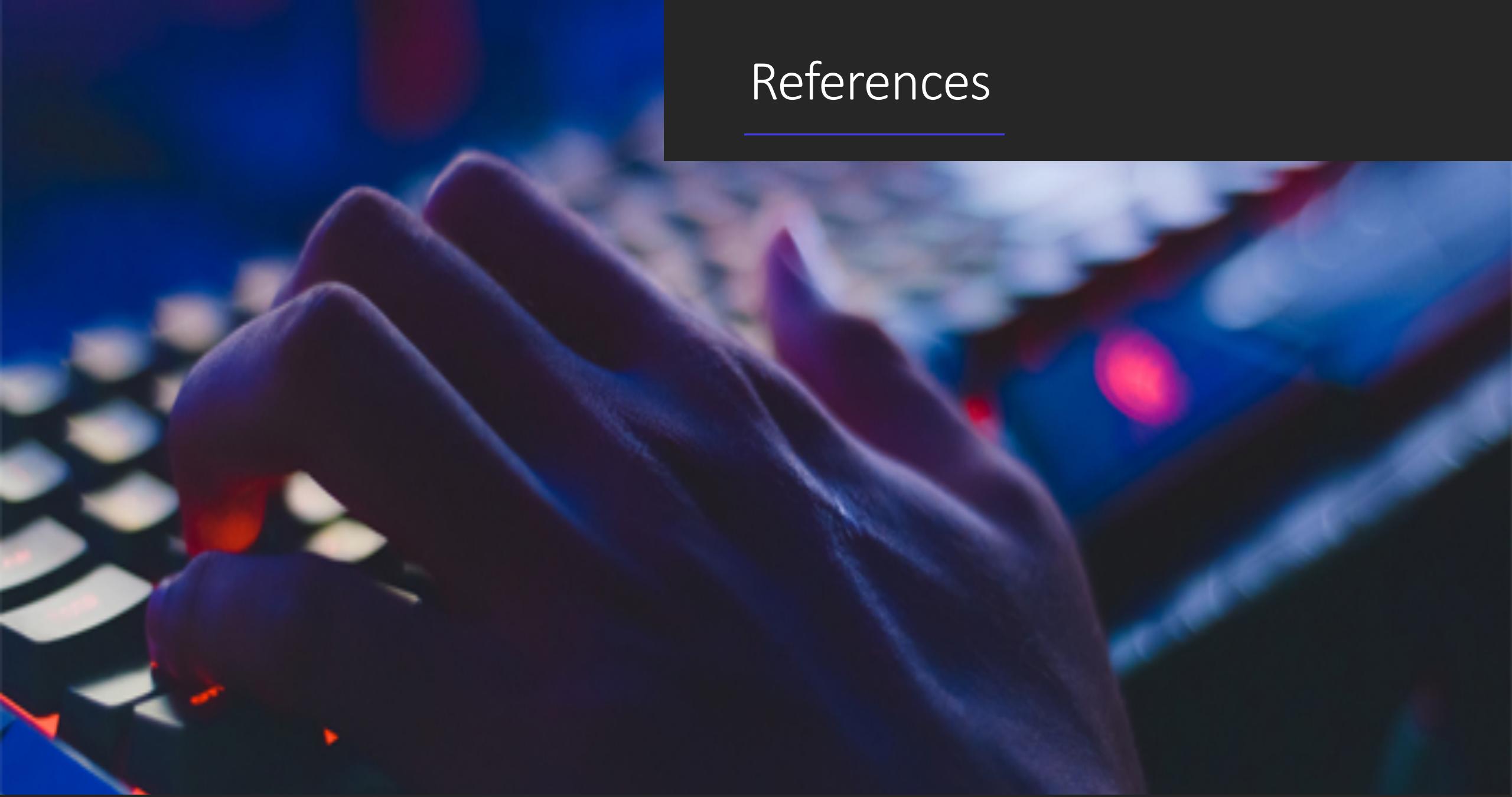
Timeline



Timeline

No	Plan	Nov	Dec	Jan	Feb	Mar	Apr	May
1	Preparation for Chapter 1-3							
2	Data Collection							
3	Model Development							
4	Write up for Chapter 4-5							
5	Submission of Report							

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Thank you.