BINUS UNIVERSITY DOCTORATE PROGRAM

People Innovation Excellence

ENCODER-DECODER WITH ATTENTION MECHANISM FOR QUESTION GENERATION

#INOVASI INDONESIA
AIS 2020 — ARTIFICIAL INTELLIGENCE SUMMIT 2020
Virtual Expo & Conference
10th–13th November 2020

QUESTION GENERATION
RESEARCH PROJECT

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RESEARCH FRAMEWORK

Problem Definition
1. Digitalization of Content and Needed to Build of knowledge and assessment
2. Online Learning relies on the interaction with Question
3. NLP as fundamental of Question Generation
4. How to develop a Question Generation model to support online learning

Research Objective
1. Generate Key-phrases from documents using the noun phrase extraction method.
2. Produce a Questions based on Bloom's Taxonomy with phrases and sentence context
3. Produce a Question Generation model with encoder-decoder and Attention mechanism that has good performance

Research Question
1. How to identify key-phrases and their context from unstructured text documents
2. How to generate questions that correspond to Bloom's Taxonomy from the context and key-phrases extracted
3. How to develop a Question Generation model that relevant with Context

State of the art
RESEARCH GAP
- So far many QG studies have used general datasets that are not learning content and produce factual or shallow questions, whereas education and learning require in-depth questions that are following Bloom's taxonomy

RESULT
1. KeyPhrase and Context
2. Performance QG Model
3. Automatic Question Generation

INPUT DATA-COLLECTION
1. Lecture Note
2. Discussion Forum
3. Learning Outcome
4. Bloom's Taxonomy

QUESTION GENERATION DESIGN
- KEYPHRASE RULE — RQ.1
- KEYPHRASE FUNCTION
- KEYPHRASE IDENTIFICATION
- KEYPHRASE #1 / KEYPHRASE #2 — RQ.2
- TEMPLATE-BASED QG
- DATASET
- ENCODER-DECODER / GRU BASED QG / LSTM BASED QG / ATTENTION MECHANISM — RQ.3
- MSE / QUESTION
- TRAINING / TESTING

EVALUATION
Algorithm Complexity
Compare of Loss Function - MSE
BLEU – Cohen's Kappa

OUTPUT
Algorithm for KeyPhrase Identification
Loss Function of Models
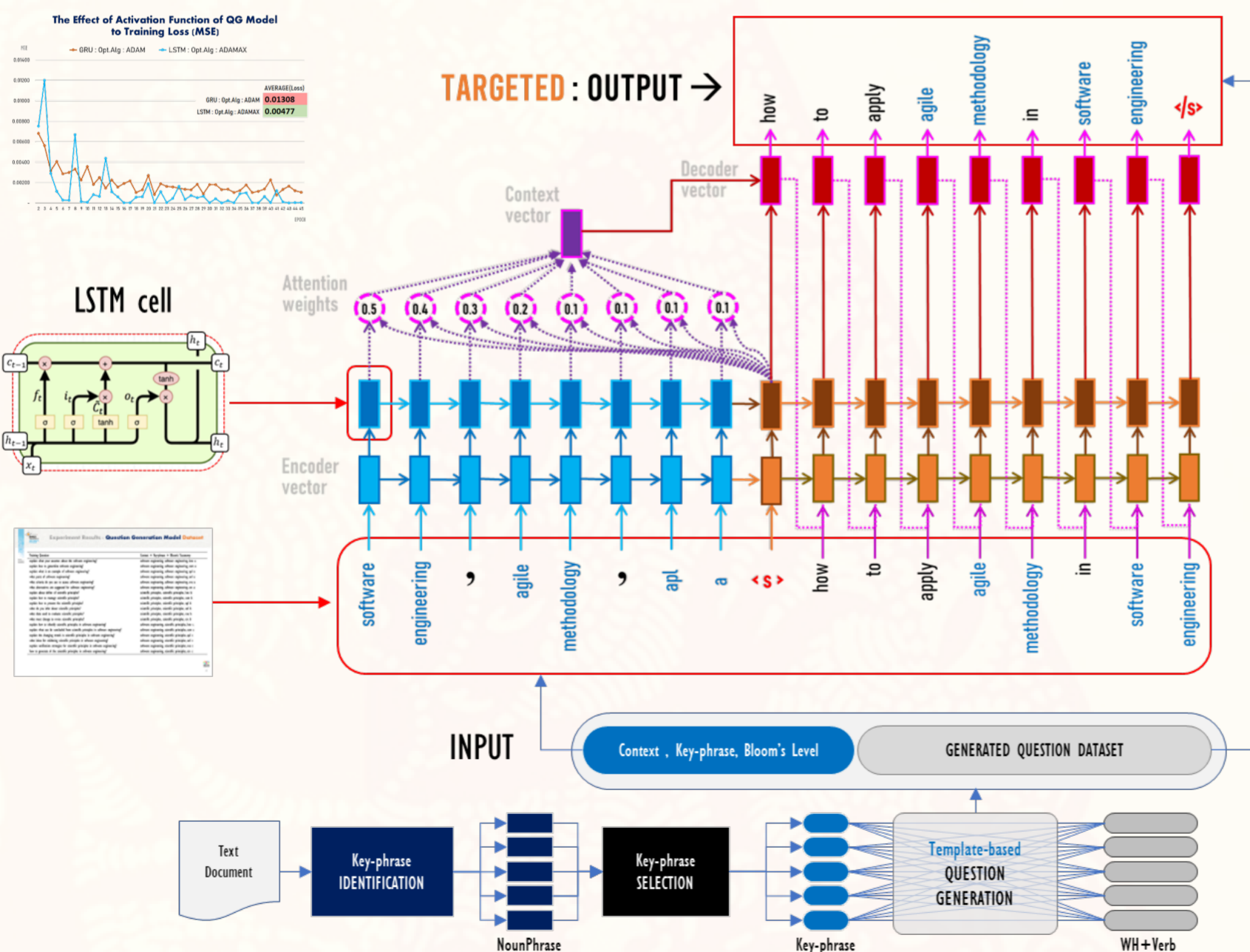Question with Context and Bloom's Taxonomy

QG Research Opportunities
The results of previous QG studies have been able to produce factoid questions and utilize semantic content pedagogically, but the relevance of questions has not been fully discussed with learning outcomes based on Bloom's taxonomy.

This is the motivation to take the opportunity with further research to find the best QG model

" Research opportunities in the QG field are still open "   Heilman, 2011

1. For mapping the answers to the question phrases.
2. Extract factual statements
3. Resolving ambiguity out of context
4. Improve Question Generation utility with deeper questions
5. Development of automatic evaluation metrics and use of languages other than English

QUESTION GENERATION DESIGN

The Effect of Activation Function of QG Model to Training Loss (MSE)

GRU : Opt.Alg : ADAM   LSTM : Opt.Alg : ADAMAX

	AVERAGE(Loss)
GRU : Opt.Alg : ADAM	0.01308
LSTM : Opt.Alg : ADAMAX	0.00477

TARGETED : OUTPUT → how to apply agile methodology in software engineering </s>

LSTM cell

Attention weights: 0.5 0.4 0.3 0.2 0.1 0.1 0.1 0.1

Context vector / Decoder vector

Encoder vector

Input: software engineering , agile methodology , apt a <s> how to apply agile methodology in software engineering

INPUT — Context , Key-phrase, Bloom's Level / GENERATED QUESTION DATASET

Text Document → Key-phrase IDENTIFICATION (NounPhrase) → Key-phrase SELECTION (Key-phrase) → Template-based QUESTION GENERATION (WH + Verb)

CONCLUSION

The issue of Question Generation is an important problem in education domain.
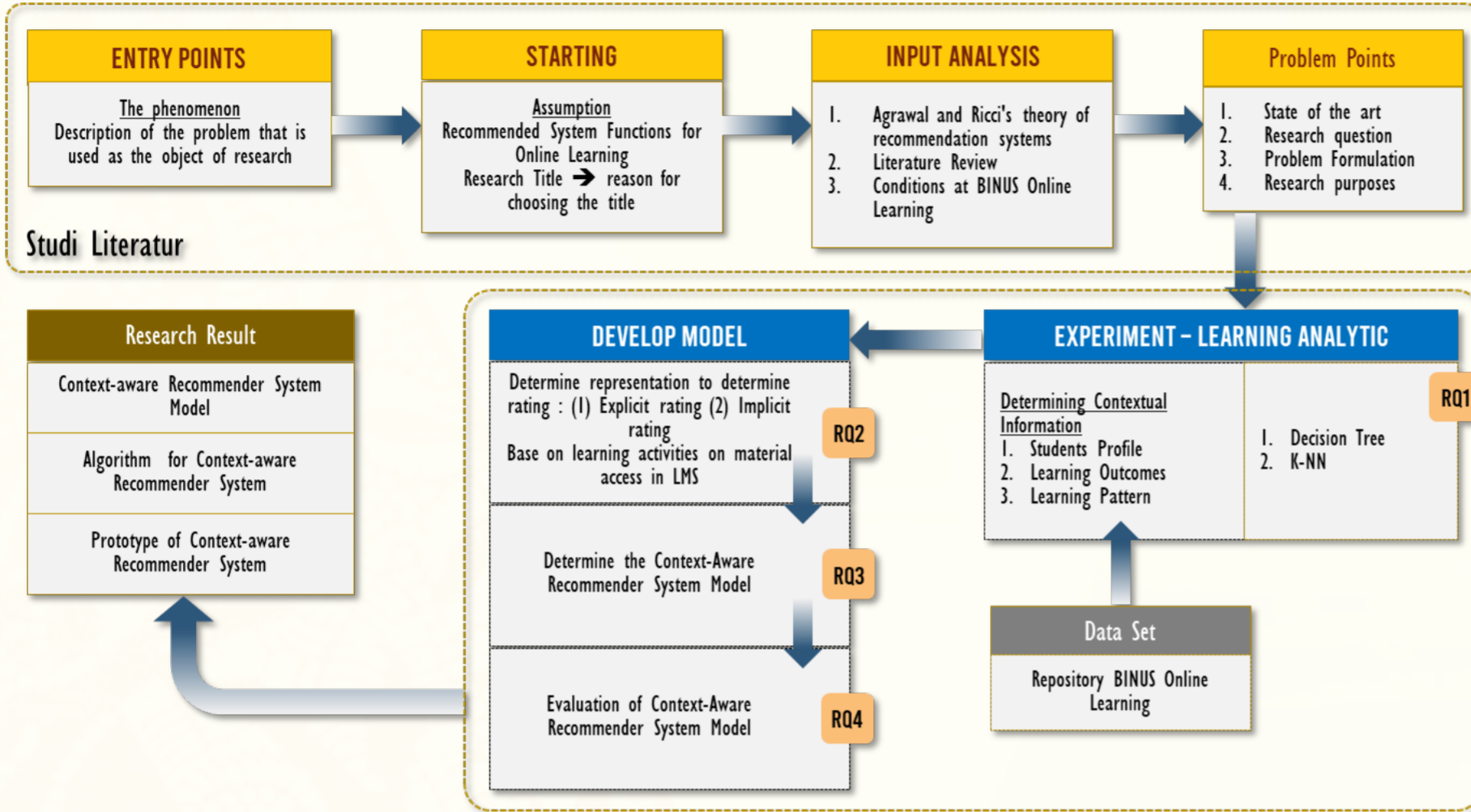
The results of this study indicate that:

1. The Key-phrase extraction process from a sentence gives a significant contribution to extract up to 3 key-phrases for Question Generation.

2. Questions generated by the use of key-phrase, contexts and operational verbs in Bloom's taxonomy can be understood semantically by humans with BLEU score of 0.92 and Cohen's Kappa score between 0.62. The Kappa score means the level of agreement among evaluators is quite good.

3. The application of LSTM cell to the encoder-decoder nodes with Attention mechanism (model#2) improves performance of the QG model by reducing the mean squared error (MSE) to 0.0003, with a BLEU score = 0.98 and Cohen's Kappa = 0.77. The BLEU score can be interpreted that the questions generated by this model can be understood by human reviewers.

The future work of this study is to examine the method for composing relevans answers from corpus based on the questions generated by the model.

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CONTEXT-AWARE RECOMMENDER SYSTEM FOR DISTANCE LEARNING

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RESEARCH FRAMEWORK

ENTRY POINTS
The phenomenon
Description of the problem that is used as the object of research

STARTING
Assumption
Recommended System Functions for Online Learning
Research Title → reason for choosing the title

INPUT ANALYSIS
1. Agrawal and Ricci's theory of recommendation systems
2. Literature Review
3. Conditions at BINUS Online Learning

Problem Points
1. State of the art
2. Research question
3. Problem Formulation
4. Research purposes

Studi Literatur

Research Result
Context-aware Recommender System Model
Algorithm for Context-aware Recommender System
Prototype of Context-aware Recommender System

DEVELOP MODEL
Determine representation to determine rating : (1) Explicit rating (2) Implicit rating
Base on learning activities on material access in LMS — RQ2
Determine the Context-Aware Recommender System Model — RQ3
Evaluation of Context-Aware Recommender System Model — RQ4

EXPERIMENT – LEARNING ANALYTIC
Determining Contextual Information
1. Students Profile
2. Learning Outcomes
3. Learning Pattern

1. Decision Tree
2. K-NN

RQ1

Data Set
Repository BINUS Online Learning

RECSYS FRAMEWORK

TEACHING AND LEARNING PROCESS
PERSONALIZATION
REPORT / UPDATE
RECOMMENDATION / USE
OPERATION DATA
ACADEMIC TRANSCRIPT
STUDENT PROFILE
LEARNING MANAGEMENT SYSTEM
ACADEMIC DATA
CUR.DEV
COURSE CONTENT
BASED ON

READ DATA
RECOMMENDER SYSTEM
LEARNING / STUDENT / COURSE
USER-COLAB / ITEM-COLAB / HYBRID
FOD / TAS / PAS / QIZ / FIN
UTILITY MATRIX
PREDICTOR
DATASET : INPUT
MACHINE LEARNING
OUTPUT PREDICTION
BASED ON

CONTEXT-RULE BASED ON STUDENT PROFILE
RULE-BASE
CONTENT-RULE BASED ON LEARNING OUTCOME
RECOMMENDATION- RULE

DASHBOARD INFORMATION
POP-UP NOTIFICATTION
OUTPUT : RECSYS

RECSYS MECHANISM IN ONLINE LEARNING

REKOMENDASI MATAKULIAH
LESSON OUTCOME
SCORE
100,00
0,00
REKOMENDASI TOPIK
Lecture Note
LEARNING ACTIVITY

Recommendation Implementation

WEEK_1 WEEK_4 WEEK_8 WEEK_10
CONTEXT
RS-MODEL : CONTEXT-BASED
SURVEY DMC (KADIS)
RS-MODEL : CONTEXT-AGG
IMPROVE CONTEXT

Sequence-based Context-Aware Learning-path Recommendation

ASSESMENT-PATH
CONTENT STUDENT PROFILE
Context-Aware
Pred_01 Pred_02 Pred_03 Pred_04 PREDICTOR
Rule Base – Learning Path : RECOMMENDATION
T.01 T.02 T.04 T.05 T.06 T.07 T.08 T.09 T.10

2201865791_FRITA RIFAATUL MAHMUDAH
ISYS6304_Business Application Development
Pred.FIN / Pred.TAS / Pred.QIZ / Pred.PAS / Pred.FOD
0.00 0.20 0.40 0.60 0.80 1.00

RECOMENDASI
Selamat yaaa, prediksi nilai mu mengalami kenaikan. Untuk menambah pengalaman belajarmu Silahkan pelajari materi tambahan berikut "https://…."
Semoga nilai tugas-tugas mu berikutnya menjadi semakin baik

DASHBOARD RECOMMENDATION SYSTEM
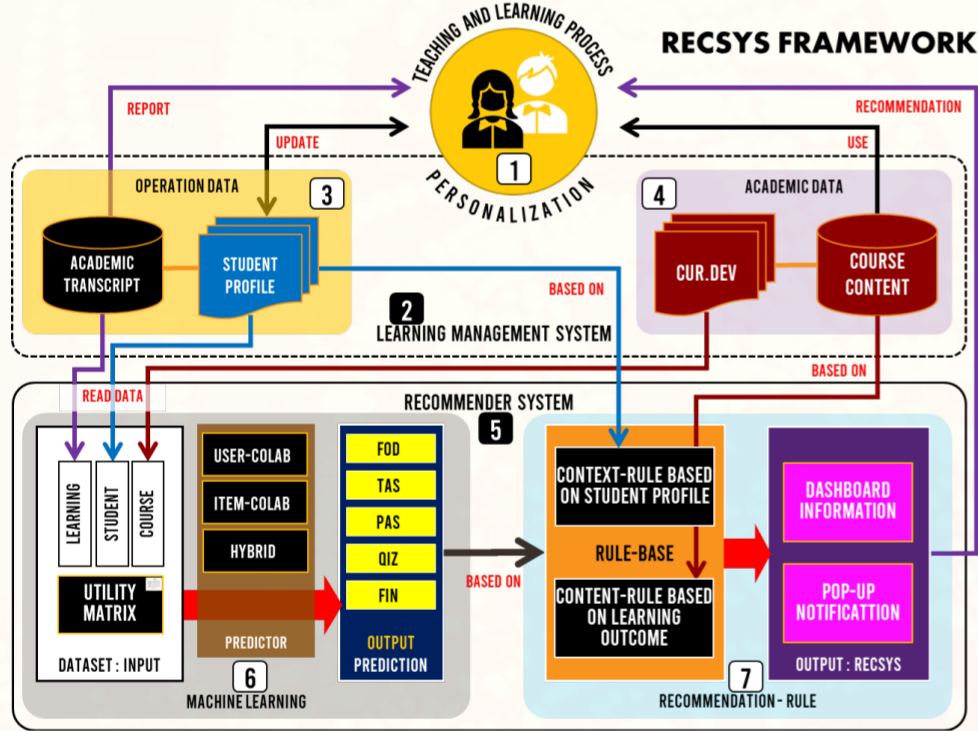
RECSYS
RECOMMENDATION SYSTEM RESEARCH PROJECT

AUTHOR :
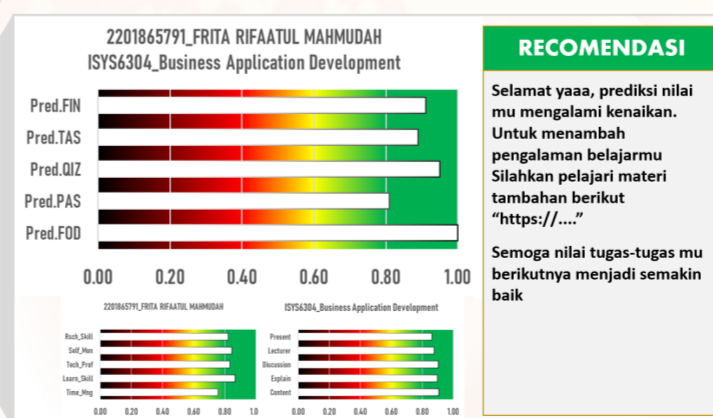Dina Fitria Murad
Sani Muhamad Isa
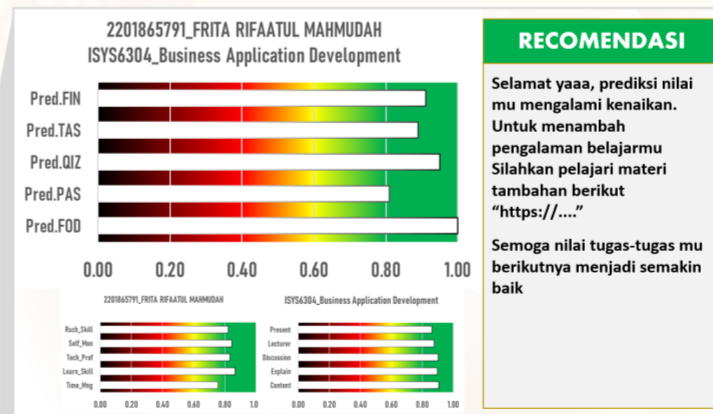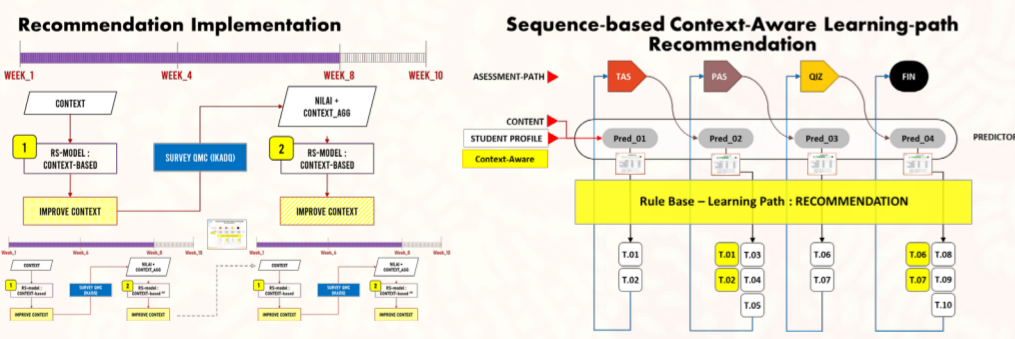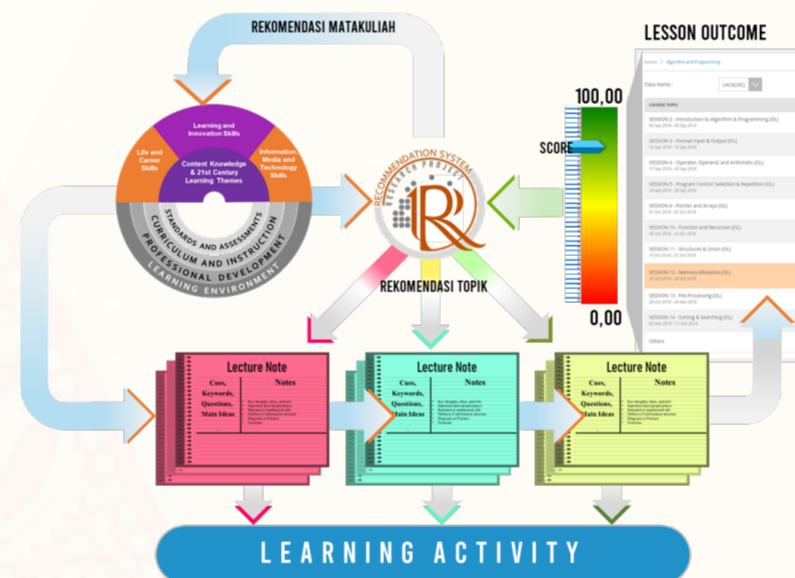Hapnes Toba
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CONCLUSION

1. Based on the four experimental results using the dataset of NILAI, Context of Students and Context of Courses, the aggregate of the three has the strongest effect on predicting rating.

2. Long-term preference (prediction of value / rating) is obtained through several experiments. Based on several models that have been tried, one model is chosen with the smallest features. The selected model uses random forest. The experimental results show that the Machine Learning Random Forest Classifier Model has the best accuracy and standard deviation.

3. The DecisionTreeRegressor model shows the smallest MSE score to predict all the Feature Value FOD, TAS, PAS, QIZ and FIN with different models.

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Education and Information Technologies

Education and Information Technologies
Q1 Education best quartile
SJR 2019 0.78 powered by scimagojr.com

Xi'an Jianzhu Keji Daxue Xuebao/Journal of Xi'an…
Q2 Architecture best quartile
SJR 2018 0.2 powered by scimagojr.com