

## Dissemination Workshop

# Adaptive Learning for Professional Development: Insights and Implementation Toolkit for Trainers

Friday, 14<sup>th</sup> March 2025

**Associate Professor Goh Yang Miang**

Principal Investigator (PI)

Director, Centre for Project and Facilities Management

### Research Team

**Dr Juliana Tay**, Assistant Professor

**Dr Punyawee Anunpattana**, Research Fellow

**Ms Sufiana Safiena**, Research Associate

**Ms Hu Xinping**, Research Assistant

**Mr Jiang Chen**, Research Assistant



## Agenda

- Introduction and housekeeping matters
- Study overview and key findings
- How to use the Toolkit
- Adaptive feature overview and implementation
- Hands-on demonstration
- Q&A session



# Introduction and housekeeping matters



## About Us

Centre for Project and Facilities Management (CPFM)

- 1 Aim to improve project and safety management through cross-disciplinary research on human and organisational factors, and technology
- 2 Adopts a systems approach to understand the factors affecting project success, safety, health, and resilience of organisations
- 3 Recognises the importance of industry involvement in its research and partners key industry stakeholders in its activities

### Our research areas





# Overview of our projects and collaborators



## Computer vision

- Poor housekeeping detection
- Open edge detection
- Workers under load detection
- PPE detection



## Safety leading indicators

- Subcontractor risk profiling
- Accident forecasting

## SKILLS<sup>future</sup> SG

### Adaptive learning

- Knowledge unit recommender
- Adaptive quiz
- Personalised feedback



## SKILLS<sup>future</sup> SG

- SafeSim Risk
- SafeSim Investigation
- SafeSim Design
- ProjectSim

## SKILLS<sup>future</sup> SG

### Self-regulated learning (SRL) [EEG and eye-tracker experiment]



THE INSTITUTION  
OF ENGINEERS,  
SINGAPORE

### Project Management Critical success factors (CSFs) and pitfalls



### Design for Safety (DfS) management framework



### Simulation for lean

## Note:

You are required to complete **all** activities in this workshop to qualify for the NUS e-certificate, PDU/ CPD points (*pending*), and \$40 voucher.

If you have *not* registered, please inform our team immediately.

- Get exclusive insights on how adaptive learning features can help boost engagement and learning outcomes
- Get practical and ready-to-use strategies to integrate adaptive learning into your own training programmes
- Get hands-on with an interactive exercise featuring personalised feedback



# Schedule

Time	Activity	Duration
2:00 pm – 2:20 pm	Introduction, study overview and key findings	20 min
2:20 pm – 2:40 pm	How to use the Toolkit	20 min
2:40 pm – 3:00 pm	Feature overview and implementation: Knowledge unit recommender (KUR)	20 min
3:00 pm – 3:20 pm	Feature overview and implementation: Adaptive quiz (AQ)	20 min
3:20 pm – 3:50 pm	Break and networking	30 min
3:50 pm – 4:10 pm	Feature overview and implementation: Personalised feedback (PF)	20 min
4:10 pm – 4:40 pm	Hands-on demonstration: Generate your own personalised feedback	30 min
4:40 pm – 5:00 pm	Q&A session, post-questionnaire and closing	20 min



# Study overview

A research study supported by SkillsFuture Singapore under the Workforce Development Applied Research Fund (WDARF) grant [GA21-04]

## Improving Professional Development through an Intelligent Adaptive Learning Approach: An in-depth study on construction project managers



## Definitions

### Adaptive Learning (AL)

- “**educational approach** that tailors the learning experience to the individual’s needs by dynamically adjusting content, assessments, and feedback based on their performance and interactions”

### Adaptive Learning System (ALS)

- “**technological framework** that enables this personalised approach, utilising data analytics, algorithms, and real-time feedback to guide learners through a customised educational journey”



# Aim and objectives

Improving professional development through an intelligent adaptive learning approach

- **Aim:** Examine the effectiveness of using an adaptive learning approach to meet the diverse learning needs of professionals in an upskilling programme
- **Objectives:**
  - Identify barriers faced by training providers and enterprises in adopting adaptive learning for professional development in Singapore
  - Develop a prototype for adaptive professional development
  - Create an adaptive learning toolkit to help trainers integrate adaptive learning into their programmes



# Project stages

Methodology

## Stage 1: Preliminary

- Examine the current state of AL adoption and views towards AL
- Conducted surveys, interviews and focus groups
- Identified top AL features rated by adult learners and trainers

## Stage 3: Deployment

- Refinement on ALS based on feedback
- Conducted quasi-experiment
- Measured effectiveness through pre-post test, perception survey, interviews, and focus group discussion

## Stage 2: Development

- Learning outcomes and content development
- Conducted quasi-experiment on vendor-based ALS
- Develop our own ALS prototype based on the top three AL features and feedback (KUR, AQ, and PF)
- Conducted user acceptance tests and pilot studies to gather feedback



## Stage 1: Preliminary

- Examine the current state of AL adoption and views towards AL
- Conducted surveys, interviews and focus groups
- Identified top AL features rated by adult learners and trainers



## Stage 2: Development

- Learning outcomes and content development
- Conducted quasi-experiment on vendor-based ALS
- Develop our own ALS prototype based on the top three AL features and feedback (KUR, AQ, and PF)
- Conducted user acceptance tests and pilot studies to gather feedback



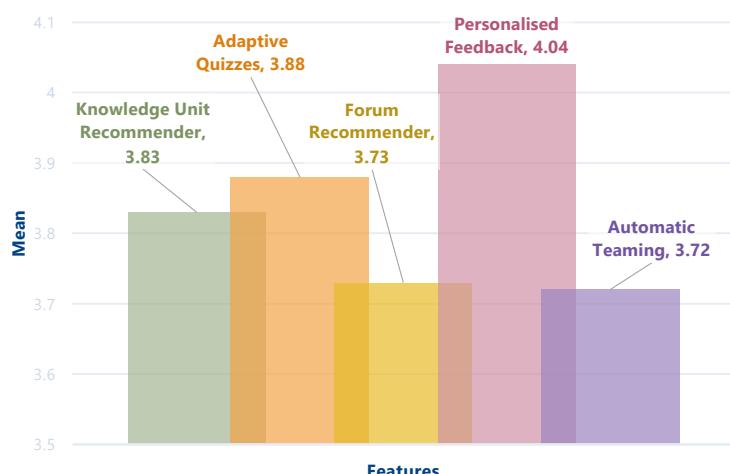
## Stage 3: Deployment

- Refinement on ALS based on feedback
- Conducted quasi-experiment
- Measured effectiveness through pre-post test, perception survey, interviews, and focus group discussion



## Ranking of adaptive features

### Stage 1: Preliminary Results



- Conducted a survey on adult learner ( $n = 343$ )
- Based on a 5-point Likert scale
- Top three (3) adaptive features ranked by adult learners:
  - Personalised feedback (4.04)
  - Adaptive quiz (3.88)
  - Knowledge unit recommender (3.83)



# Focus group discussions

## Stage 1: Preliminary Results

"Adaptive learning... is a new way of learning experience. So, I strongly recommend this... I find that this is **very much useful**, you know, for the professionals, you know, to get engaged with..."

"I think there should be **some sharing or introduction session**... before everyone knows about this... there should be some sharing to have some general ideas for the potential attendees"

"It will be **more efficient, more targeted**. I think it will **save time** on the part of both lecturer and students"

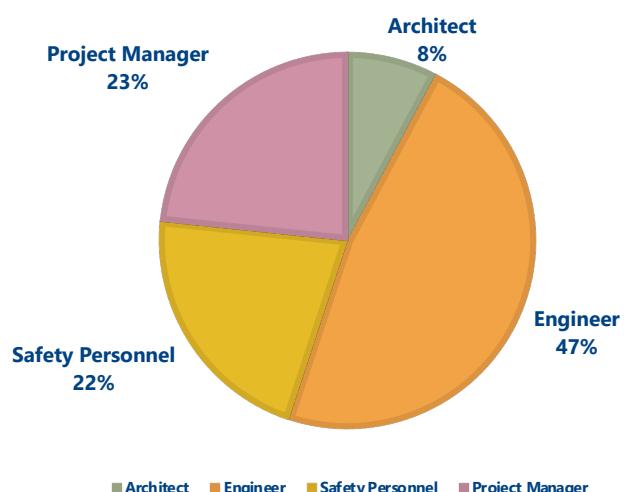
"The lecturers themselves must be **properly trained**... There must be a training process for the lecturers, and the training process must be **hands-on**".

Based on their roles in the construction projects



# Participants demographics

## Stage 2: Development Results





## Evaluation stages

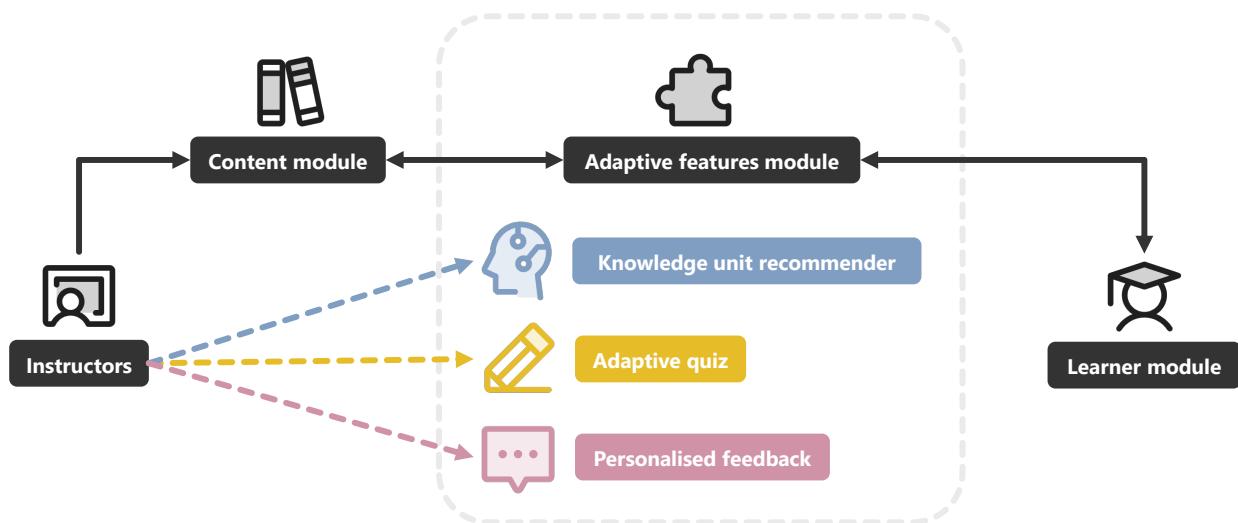
### Stage 2: Development Results

Stage	Description of features tested	n	Remarks
<b>QE 1</b> 27 <sup>th</sup> Nov – 17 <sup>th</sup> Dec 2023	Using commercialised ALS	94	Online course
<b>UAT 1A</b> 14 <sup>th</sup> Jun / 21 <sup>st</sup> Jun 2024	Adaptive quiz (AQ) + Personalised feedback (PF) prototype	28	Workshop
<b>UAT 1B</b> 19 <sup>th</sup> – 25 <sup>th</sup> Aug 2024	Knowledge unit recommender (KUR) + Personalised feedback (PF) prototype	56	Online course
<b>QE 2</b> 25 <sup>th</sup> Nov – 31 <sup>st</sup> Dec 2024	KUR + AQ + PF prototype	83	Online course



## Adaptive learning framework

### Key components to develop ALS for PD



# Content

KA/PG	(A) Initiating	(B) Planning	(C) Executing	(D) Monitoring & Controlling	(E) Closing
(1) Integration	02-02 Pre-initiating processes 02-03 Overview of initiating 02-04 Develop project charter	1 03A-02 Key PM plan components and change management plan 03A-02b Roles of stakeholders and configuration management plan 03A-02c Change management versus configuration management 03A-02d Configuration management plan 03A-02e Common elements in PM plans	2 04A-02a Deliverables and work performance data 04A-02b Issue log and change request 04A-02c Manage project knowledge	3 05A-02a Monitor and control project work 05A-02b Work performance report 05A-02c Earned value management (EVM) 05A-02d Project status reports and forecasts 05A-02e Summary of EVM 05A-02f Perform integrated change control	4 06-02a Common ways to close or terminate projects 06-02b Tasks during closing 06-02c Example of just-in-time project closing 06-02d Project closing and warranty period 06-02e Lessons learnt
(2) Scope		03B-02a Plan scope management 03A-02b Collect requirements 03A-02c Define scope 03A-02d Create a detailed definition of work breakdown structure (WBS) 03A-02e Developing a good WBS	6	05A-04 Validate scope 05A-05 Control scope	7
(3) Schedule		03B-02a Develop schedule management plan 03B-02b Define activities 03B-02c Sequence activities 03B-02d Establish timing 03B-02f Estimate activity duration 03B-02g Establish baseline 03B-02h Critical path method 03B-02i Schedule compression 03B-02j Resource leveling	8	05A-06 Control schedule	9
(4) Cost		03B-02a Plan cost management 03B-02b Estimate costs 03B-02c Develop budget baseline and budgeting components 03B-02d Examples of common project budgeting 03B-02e Cost baseline, expenditure and funding requirements	10	05A-07 Control costs	11
(5) Quality		03C-02a Principles of quality management 03C-02b Quality metrics	12	04A-02a Benefits of manage quality process, tools and techniques 04A-02b Quality report	13 05B-02a Overview of quality control tools 05B-02b Quality control tools (Cause and effect diagram, check sheet, control chart, histogram) 05B-02c Quality control tools (Pareto chart, scatter diagram, and stratification)
(6) Resource		03C-02a Plan resource management 03C-02b Project organizational chart and responsibility assignment matrix 03C-02c Resource histogram 03C-02d Staff management plan 03C-02e Estimating activity resources	15	04B-02 Acquiring resources 04B-02a Developing project team 04B-02b Team building activities 04B-02c High-performing teams and team building activities 04B-02d MTB and TRACOM Social Style model 04B-02e Team communication systems 04B-02f Cultural diversity 04B-02g Team management 04B-02h Example of conflict management in construction projects 04B-02i Conflict resolution process and importance of EQ 04B-02j Managing teams	16 05B-03 Control resources
(7) Communications					
(8) Risk					
(9) Procurement		03D-02a Plans and reserves 03D-02b Approaches to risk and procurement management	24	04A-02a Approaching and selecting sellers and suppliers 04A-02b Standard agreements in construction industry	25 05B-02a Examples of procurement activities 05B-02b Quality of control 05B-02c Financial management and effective change management
(10) Stakeholder	02-05 Stakeholder identification 02-06 Kick-off meeting	27 03C-02a Stakeholder engagement plan and power/interest grid 03C-02b Stakeholder engagement level categories 03C-02c Example of stakeholder engagement plan	28	04B-02a Manage stakeholder engagement 04B-02b Construction project example	29 05B-02b Monitor stakeholder engagement
					30

We used the PM matrix to develop our course.

**Column:** Process groups (initiating, planning, executing, monitoring and controlling, and closing)

**Row:** Knowledge areas (integration, scope, schedule, cost, quality, resources, communication, risk, procurement, and stakeholder)

## How to use the Toolkit





# Structure of the Toolkit

Key features & workflow

Implementation guidelines

Best practices & considerations

Templates & checklists

- Examples are from our study and experiences
- Target participants were construction and built environment professionals
- Applied on project management course



# Key considerations

when designing ALS for PD

Adult learner characteristics



Self-direction, flexibility and critical thinking



Experience-based, practical and social learning



Relevance and goal-oriented learning

1

Relevance to the professional context

2

Learner profiling

3

Time constraints



## 1 Relevance to the professional context

- Adult learners value autonomy and prefer control over their education
- Integrate new knowledge with personal, professional, and social experiences
- Practical applications addressing real-world challenges are important
- Should support self-regulated learning



# Considerations

## Real-world application

The content should be authentic and mirror workplace challenges, decisions, and tasks to ensure immediate application on the job.

## Industry-specific content

Learning materials should be regularly updated to reflect current trends, policies, and best practices.

## Learner autonomy

Provide opportunities for learners to choose topics, projects, or assessments that align with their professional goals.



## 2 Learner profiling

- One-size-fits-all approach is ineffective
- Essential content for one learner may be irrelevant or too complex for another
- Adaptive learning strategies help tailor content to individual needs
- Constructive feedback supports reflection, plan adjustments, and performance improvement



# Considerations

## Needs-based customisation

Offer personalised learning paths based on prior knowledge, job roles, or career aspirations, and use assessments or AI-driven algorithms to adjust content difficulty based on learner performance.

## Constructive feedback

Provide actionable feedback to guide learners in refining their skills and approaches.

## Collaborative learning

Encourage peer discussions, mentorships, and networking to facilitate knowledge-sharing.

## 3

### Time constraints

- Professional juggle work, family, and personal commitments, making rigid schedules impractical
- Should offer flexible, modular content for self-paced learning
- Bite-sized lessons and on-demand resources help integrate learning into daily routines



## Considerations

### Asynchronous, modular and flexible learning formats

Offer self-paced, hybrid, or microlearning modules to accommodate different schedules and enable learners to access materials anytime, reducing dependency on fixed schedules.

### Bite-sized content

Deliver information in short, focused segments to maximise retention and minimise time commitment.



## Development, integration & other considerations



### System architecture and infrastructure



### Data management and security



### Interoperability, integration and system considerations



### User experience and accessibility



### Expert collaboration and continuous improvement



## System architecture and infrastructure

- Supports cloud-based, on-premises, and hybrid models for flexibility and scalability
  - Cloud solutions enable remote access, automatic updates, and scalability
  - On-premises setups offer enhanced security and compliance
  - Hybrid approaches balance flexibility and control
- Must handle high user loads and real-time data processing
- Requires continuous monitoring, performance optimisation, and updates for stability



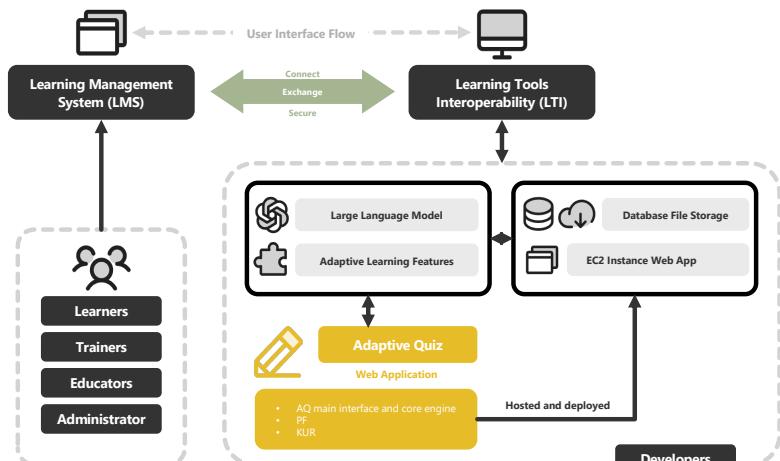
## Data management and security

- Ensure ethical data handling
- Compliance with GDPR, PDPA and other data privacy regulations
- Secure practices include encryption, access controls, and anonymisation
- Prevents unauthorised access and data breaches



# Interoperability, integration & system considerations

- Seamless integration with LMS platforms like Moodle, Blackboard, and Canvas
- Learning Tool Interoperability (LTI) enables smooth communication between systems
- Uses APIs, standardised protocols, and secure data transmission



# Interoperability, integration & system considerations

Example technology stacks for an ALS

Backend	Frontend	Database	Server	LLM	Canvas LMS
<ul style="list-style-type: none"><li>Flask (Python)</li></ul>	<ul style="list-style-type: none"><li>jQuery (JavaScript)</li><li>HTML/CSS</li></ul>	<ul style="list-style-type: none"><li>SQLite3</li><li>Pinecone</li></ul>	<ul style="list-style-type: none"><li>Amazon Web Service (AWS)</li><li>EC2, VPC, RDS</li></ul>	<ul style="list-style-type: none"><li>OpenAI</li><li>ChatGPT4o model</li></ul>	<ul style="list-style-type: none"><li>REST API</li><li>LTI</li></ul>



## User experience and accessibility

- User engagement through intuitive interfaces and interactive elements
  - Compliance with Web Content Accessibility Guidelines (WCAG) 2.1 for accessibility
  - Features like captioned videos, adjustable font sizes, and keyboard navigation enhance inclusivity
  - Responsive design ensures compatibility across devices (desktop, tablet, mobile)
- Regular usability testing and user feedback improve experience



## Expert collaboration & continuous improvement

- Monitoring for updates, bug fixes, and performance improvements
- Uses feedback, analytics, and AI advancements for refinement
- Regular updates to content, algorithms, and user experience for relevance
- Requires collaboration between the course developers and experts



## Expert collaboration & continuous improvement

Objectives	Suggested experts
<b>Development of learning objectives and content</b> Establish the objectives and learning materials that must be met upon completion of the course	<ul style="list-style-type: none"><li>• Course developers</li><li>• Industry experts</li><li>• Institution representative</li></ul>
<b>Development of adaptive features</b> Establish the requirements for adaptive features and development of the algorithm	<ul style="list-style-type: none"><li>• Course developers</li><li>• Software developers</li><li>• Research engineers</li><li>• Industry experts</li></ul>
<b>Integration to the LMS</b> Establish the requirements and solutions for integrating adaptive features into LMS	<ul style="list-style-type: none"><li>• Course developers</li><li>• LMS developers and specialists</li><li>• Institution representative</li></ul>



## Where to get the Toolkit?

- Download the latest version here:

<https://bit.ly/ALS-Toolkit>

You can also scan  
the QR code.





## Adaptive feature overview and implementation

---



## Knowledge unit recommender

---

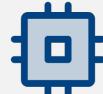


# Key features of KUR



## Personalisation and adaptive learning paths

Tailor recommendations based on a learner's background, skill level, and learning goals, and adjust learning sequences dynamically based on learner progress and assessment results



## AI-driven recommendations

Uses AI-driven techniques to generate personalised learning paths by considering learners' profile and course content



## Knowledge graphs and content mapping

Organises learning resources into structured knowledge units (KUs) and ensures a logical learning progression through interconnected concepts

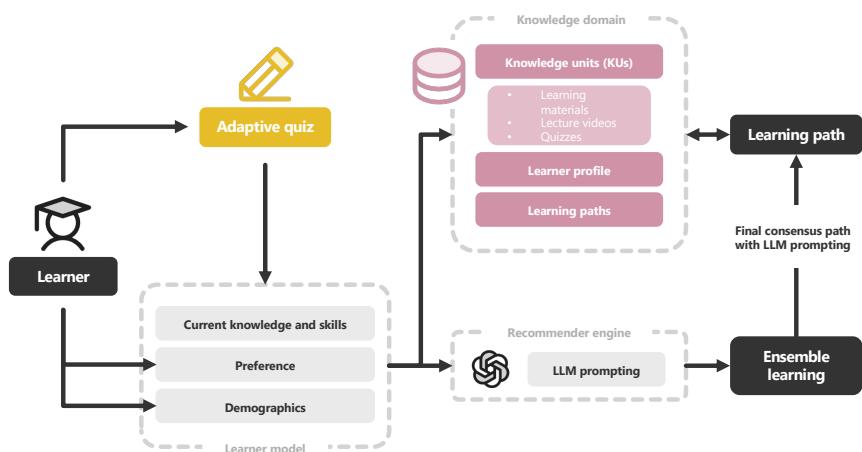


# Suggested KUR workflow

Generating optimised pathways for professionals by tailoring content based on background, assessments, and preferences

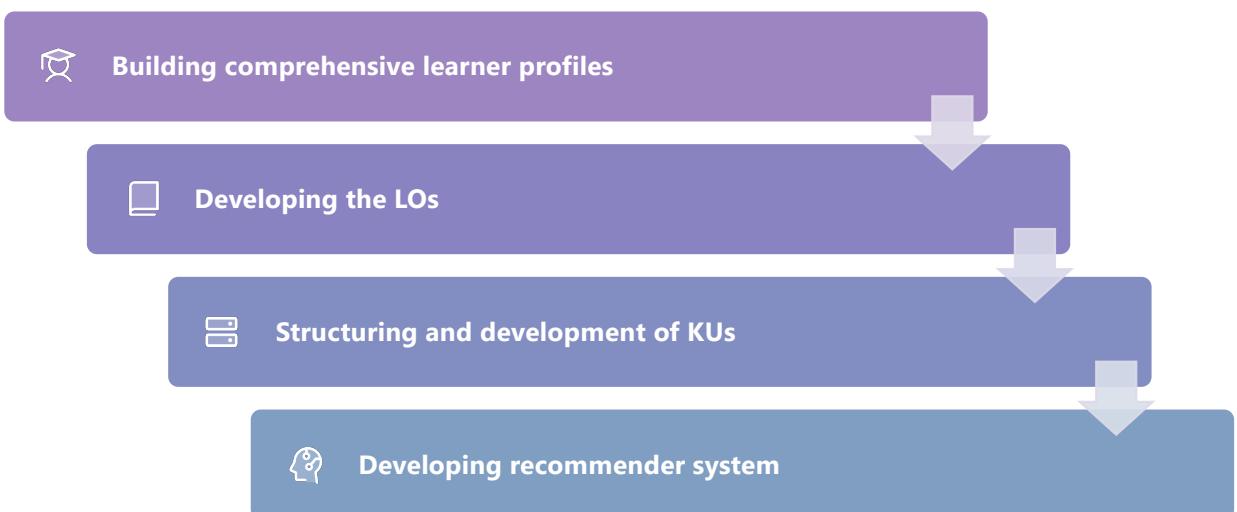
## Components

- 1 Learner model
- 2 Knowledge domain
- 3 Recommender engine
- 4 Ensemble learning





# Implementation Guidelines for KUR



## Building comprehensive learner profiles

Collecting essential data to understand learners' attributes

Category	Data	Methods
<b>1) Demographics and professional background</b> Helps determine the suitability of the content for the learner by aligning recommendations with industry standards and career progression to support specific job functions	<ul style="list-style-type: none"><li>• Job title and industry</li><li>• Years of experience</li><li>• Education level and certifications</li></ul>	Questionnaire
<b>2) Learning preferences and interests</b> Different professionals engage with content differently	<ul style="list-style-type: none"><li>• Preferred learning format</li><li>• Preferred course structure</li><li>• Topic of interests</li><li>• Availability and time constraints</li></ul>	Questionnaire
<b>3) Knowledge level and baseline assessment</b> Determine the learner's level or " <i>starting point</i> " and sequence of knowledge units to prevent redundancy by ensuring learners focus on areas where they need improvement	<ul style="list-style-type: none"><li>• Pre-assessment scores</li><li>• Self-evaluation ratings</li><li>• Past quiz results</li><li>• Course completions</li><li>• Engagement patterns</li></ul>	Questionnaire, baseline test, historical learning records



# Building comprehensive learner profiles

## How we implement in our ALS PD course

- Collect through pre-questionnaire before the course, user testing, pilots, and quasi-experiment

Section 1: Participant Information		
Gender:	<input type="checkbox"/> Female <input type="checkbox"/> Male	<input type="checkbox"/> Prefer not to answer
Highest Qualification:	<input type="checkbox"/> GCE O Levels <input type="checkbox"/> GCE A Levels/Diploma <input type="checkbox"/> Bachelors	<input type="checkbox"/> Masters <input type="checkbox"/> Doctoral <input type="checkbox"/> Others: _____
What is your discipline or major of your highest qualification?		
How long have you worked in the industry?	<input type="checkbox"/> < 1 year <input type="checkbox"/> 1 – 5 years <input type="checkbox"/> 6 – 10 years	<input type="checkbox"/> 11 – 15 years <input type="checkbox"/> 16 – 20 years <input type="checkbox"/> > 20 years
What is your role in the construction and the built environment industry?		
What is your company name?		
What is your position/ title in your company?		
How many projects have you managed or been heavily involved in?	<input type="checkbox"/> 0 <input type="checkbox"/> 1 – 5 <input type="checkbox"/> 6 – 10	<input type="checkbox"/> 11 – 15 <input type="checkbox"/> 16 – 20 <input type="checkbox"/> > 20

Section 2: Experiences in Adaptive Learning	
Do you have experience with adaptive learning for professional development?	<input type="checkbox"/> Yes <input type="checkbox"/> No
If the answer to the previous question is yes, how often do you engage in online learning courses or training activities?	<input type="checkbox"/> Yearly <input type="checkbox"/> Monthly <input type="checkbox"/> Weekly <input type="checkbox"/> Daily <input type="checkbox"/> Rarely
Do you prefer online or in-person learning environments or a combination of both (hybrid)?	<input type="checkbox"/> Online <input type="checkbox"/> In-person <input type="checkbox"/> Both
Do you have access to the necessary technology (e.g., computer, internet) to participate in online learning activities?	

Section 3: Learning Preference	
Please rank the following process groups according to your learning preferences:	
<input type="checkbox"/> Initiating Process Group <input type="checkbox"/> Planning Process Group <input type="checkbox"/> Executing Process Group <input type="checkbox"/> Monitoring and Controlling Process Group <input type="checkbox"/> Closing Process Group	
Please rank the following knowledge areas according to your learning preferences:	
<input type="checkbox"/> Integration Management <input type="checkbox"/> Scope Management <input type="checkbox"/> Schedule Management <input type="checkbox"/> Cost Management <input type="checkbox"/> Quality Management <input type="checkbox"/> Risk Management <input type="checkbox"/> Communication Management <input type="checkbox"/> Procurement Management <input type="checkbox"/> Stakeholder Management	



# Developing the LOs

- Guide content creation and ensure alignment with learning outcomes
- Help learners understand their goals and keep learning focused and relevant
- Each KU should have specific, measurable, and practical objectives

## ☰ Considerations

### Structure and align your LOs with Bloom's Taxonomy

Bloom's Taxonomy is a widely recognised framework for structuring LOs to facilitate effective learning and skill development. It categorises cognitive learning into six levels, progressing from basic knowledge recall to higher-order thinking and problem-solving.



# Developing the LOs

## How we implement in our ALS PD course

### Course learning objectives

#### At the end of the course, learners should be able to:

- Explain the five phases of the predictive project management life cycle and the ten project management knowledge areas.
- Develop key project initiation documents, including the project charter, assumption log, and stakeholder register.
- Create a comprehensive project management plan for scope, schedule, cost, quality, resources, communications, stakeholder engagement, risk, and procurement management.
- Demonstrate how to implement project execution processes, such as Directing and Managing Project Work, Managing Project Knowledge, Managing Quality, Acquiring Resources, Developing and Managing Teams, Managing Communications, Implementing Risk Responses, Conducting Procurements, and Managing Stakeholder Engagement.
- Apply project monitoring and controlling processes, including work performance reports, earned value management metrics, integrated change control, scope validation, and controls for schedule, cost, quality, resources, procurement, communications, risks, and stakeholder engagement.
- Execute project closing activities by preparing formal customer acceptance, final project reports, lessons learned registers, and conducting project closure meetings.

## Example of LOs

### "Cell 1: Initiating Integration Management" learning objectives

**Note:** This cell contains three (3) KUs (i.e., pre-initiating processes, overview of initiating, develop project charter)

- Describe the content of a business case
- Describe the pre-initiating processes
- Describe the processes in the initiating process group
- Develop a project charter and assumption log

### "Cell 22: Executing Risk Management" learning objectives

**Note:** This cell contains only one (1) KU (i.e., implement risk response)

- Explain how risk responses are implemented as part of risk management execution processes



# Structuring and development of KUs

## Modular and bite-size learning activities

- Topic area and knowledge domain
- Difficulty level (i.e., beginner, intermediate, advanced)
- Estimated completion time
- Learning format (i.e., video, quiz, exercise, reading material, etc.)



## Guidelines

**Content should be in bite-size (< 10 minutes)**

**Modular in structure**

**Define the pre-requisite (if any)**

# Structuring and development of KUs

## How we implement in our ALS PD course

KU#	Referring	All Referring	01 Planning	02 Executing	03 Monitoring & Controlling
(1) Integration	02-02 Pre-initiating processes 02-03 Overview of initiating 02-04 Develop project charter	02A-01 Key management and large management skills 02A-02 Roles of stakeholders and configuration management plan 02A-03 Stakeholder identification 02A-04 Stakeholder engagement 02A-05 Stakeholder management 02A-06 Stakeholder engagement matrix 02A-07 Stakeholder analysis	2 02A-01 Definition and key performance data 02A-02 Stakeholder identification and change management data 02A-03 Issue log and change request 02A-04 Stakeholder engagement 02A-05 Manage project knowledge	3 02A-01 Monitoring and controlling process data 02A-02 Issue log and change request 02A-03 Stakeholder identification and change management 02A-04 Stakeholder engagement 02A-05 Manage project knowledge	04B-02 Acquiring resources 04B-03a Developing project team 04B-03b Tuckman model of team development 04B-03c High-performing teams and team building activities 04B-03d MBTI and TRACOM Social Style model 04B-03e Reward and recognition systems 04B-03f Cultural diversity 04B-04a Conflict management 04B-04b Example of conflict management in construction projects 04B-04c Conflict resolution process and importance of EQ 04B-04d Managing teams 04B-04e Leader versus manager 04B-04f Leadership styles 04B-04g Extrinsic and intrinsic motivation 04B-04h Motivation theories 04B-04i How motivation influences projects
(2) Scope	02A-06 Work scope management 02A-07 Configuration management 02A-08 Quality management 02A-09 Overview of work breakdown structure (WBS) 02A-10 Developing a good WBS		4 02A-01 Control scope		04B-05 Monitor scope 04B-06 Control scope
(3) Schedule	02B-01 Overall project management plan 02B-02 Resource management plan 02B-03 Resource allocation 02B-04 Resource availability 02B-05 Resource leveling 02B-06 Resource management 02B-07 Resource planning 02B-08 Resource requirements 02B-09 Resource scheduling 02B-10 Resource utilization		5 02B-01 Control schedule		
(4) Cost	02B-01 Plan cost management 02B-02 Resource management plan 02B-03 Resource allocation 02B-04 Resource availability 02B-05 Resource leveling 02B-06 Resource management 02B-07 Resource planning 02B-08 Resource requirements 02B-09 Resource scheduling 02B-10 Resource utilization		6 02B-01 Control costs		
(5) Quality	02C-01 Quality management 02C-02 Quality control 02C-03 Quality improvement		7 02C-01 Benefits of manage quality process, tools and techniques 02C-02 Overview of quality management 02C-03 Quality control tools and techniques 02C-04 Quality improvement tools and techniques	13 02C-01 Overview of quality management 02C-02 Quality control tools and techniques 02C-03 Quality improvement tools and techniques	04B-05 Monitor quality 04B-06 Control quality
(6) Resource	02E-01 Plan resource management 02E-02 Resource allocation and responsibility assignment 02E-03 Resource leveling 02E-04 Resource management 02E-05 Resource planning 02E-06 Resource requirements 02E-07 Resource scheduling 02E-08 Resource utilization		8 02E-01 Resource management 02E-02 Resource allocation and responsibility assignment 02E-03 Resource leveling 02E-04 Resource management 02E-05 Resource planning 02E-06 Resource requirements 02E-07 Resource scheduling 02E-08 Resource utilization	14 02E-01 Resource management 02E-02 Resource allocation and responsibility assignment 02E-03 Resource leveling 02E-04 Resource management 02E-05 Resource planning 02E-06 Resource requirements 02E-07 Resource scheduling 02E-08 Resource utilization	04B-05 Monitor resources 04B-06 Control resources
(7) Communication	02G-01 Communicate management plan 02G-02 Communicate stakeholder information 02G-03 Project information		9 02G-01 Manage communications 02G-02 Stakeholder communication 02G-03 Project communication	15 02G-01 Manage communications 02G-02 Stakeholder communication 02G-03 Project communication	04B-05 Monitor communication
(8) Risk	02H-01 Risk management plan 02H-02 Risk register 02H-03 Categories of project risks 02H-04 Risk tolerance 02H-05 Risk report 02H-06 Qualitative risk analysis 02H-07 Quantitative risk analysis 02H-08 Patterns of qualitative risk analysis 02H-09 Risk response 02H-10 Risk response 02H-11 Risk response 02H-12 Risk response 02H-13 Procurement risk management		10 02H-01 Implement risk responses	21 02H-01 Implement risk responses	04B-05 Monitor risks
(9) Procurement	02D-01 Procurement management plan 02D-02 Contract types, contract management 02D-03 Contract types, common standard form of contracts and project documents 02D-04 Bid documents and statement of work 02D-05 Procurement risk management 02D-06 Procurement risk matrix 02D-07 Procurement related risk management		11 02D-01 Approaching and selecting sellers and suppliers 02D-02 Standard agreements in construction industry 02D-03 Impact of laws on risk of procurement	24 02D-01 Approaching and selecting sellers and suppliers 02D-02 Standard agreements in construction industry 02D-03 Impact of laws on risk of procurement	04B-05 Monitor procurement activities 04B-06 Financial management and effective change management
(10) Stakeholder	02-04 Stakeholder identification 02-06 Kick-off meeting		12 02E-01 Manage stakeholder engagement 02E-02 Construction project lifecycle	26 02E-01 Manage stakeholder engagement 02E-02 Construction project lifecycle	04B-05 Monitor stakeholder engagement
			27	28	29

16

© NATIONAL UNIVERSITY OF SINGAPORE

47

# Structuring and development of KUs

## How we implement in our ALS PD course

WEEK 2 | MODULE 2 | Initiating Process Group

- Module 02 Lecture Videos
- Module 02 Handout
- Module 02 Practice Quiz
- Module 02 Discussion: Project Charter
- Module 02 Supplementary Discussion: Stakeholder Identification (Sydney Airport)

mod. no.	cell no.	ref. no.	description	duration
2	1	02-02	Pre-initiating processes	0:06:19
2	1	02-03	Overview of initiating	0:01:49
2	1	02-04	Develop project charter	0:09:32
2	27	02-05	Stakeholder identification	0:03:39
2	27	02-06	Kick-off meeting	0:02:00

## MODULE 02

### INITIATING PROCESS GROUP

Estimated completion time: 30 min

In this module, you will learn about pre-initiation processes and how to initiate a project. Most of the materials are based on *Project Management Best Practices (PMB)*. You can download a copy of *PMB* [here](#).

[Start to Module 02](#)

**Learning Outcomes**

At the end of the module, learners should be able to:

- Describe the context of a business case
- Describe the processes in the initiating process group
- Describe the processes in the initiating process group
- Perform stakeholder identification during project initiation
- Hold a project kick-off meeting

**Video Lectures**

02-01 Introduction 01:08

02-02 Pre-initiating processes 0:04:19

02-03 Pre-initiating processes 0:04:19

02-04 Pre-initiating processes 0:04:19

02-05 Pre-initiating processes 0:04:19

02-06 Pre-initiating processes 0:04:19

© NATIONAL UNIVERSITY OF SINGAPORE

48

# Developing the recommender engine, algorithm and feedback loop

- Core component that generates personalised learning pathways based on learner data
- Requires selecting appropriate algorithms for effective recommendations
- Continuous refinement improves learning outcomes and system effectiveness

## Guidelines

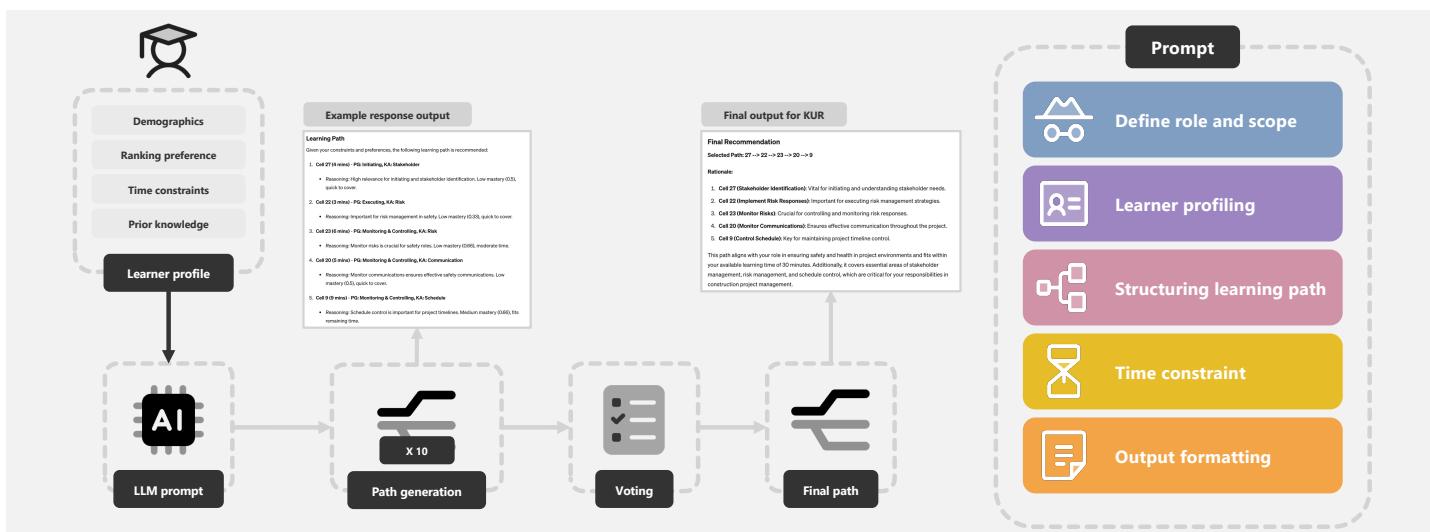
Logical sequencing of knowledge units

Dynamic adaptation based on learner progress

Estimated completion times for effective planning

## KUR workflow

Using LLM recommender



</> LLM prompt: Generating personalised learning path

# KUR workflow

## How we implement in our ALS PD course

 Define role and scope

 Learner profiling

 Structuring learning path

 Time constraint

 Output formatting

You are an experience project manager trainer and course developer for Project Management course. This course is divided into five (5) process group (PG): Initiating, Planning, Executing, Monitoring and Controlling, and Closing, and each containing ten (10) knowledge areas (KA): Integration, Scope, Schedule, Cost, Quality, Resources, Communication, Risk, Procurement, and Stakeholders. Learners can rank their preferences for these modules and knowledge areas from 1, 2, 3, 4, 5 and 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 respectively, prioritising based on career needs and prior knowledge.

Here are the details of each cell based on PG and KA:  
Cell 1 (PG = Initiating, KA = Integration) – Develop project charter  
... [details of Cells 2 to 29]  
Cell 30 (PG = Monitoring and Controlling, KA = Stakeholder) – Monitor stakeholder engagement

I have a time constraint and can learn the recommended path within timeframe of 180 minutes. Strictly adhere to the time constraint and do not exceed 180 minutes. If the time exceeds the time constraint, the recommendation will be rejected. Different cells need learning timeframe. Cell-mins pair: {1: 29, ..., 30: 8}. For example, if I were to study Cell 1, I would have to spend 29 minutes.

The learner is a Workplace Safety and Health Officer with 11 to 16 years of experience in construction industry. Their preferred learning style includes lecture videos and ungraded exercises. Their pre-test scores indicate strengths in executing risk management and weaknesses in planning process group.

Please recommend a learning path according to the learner's background and prior knowledge. Return only the path. Do not list intermediate paths. You must provide the path and strictly in this format: [1, 2, nth]. Do provide the selection criteria and summarise the rationale behind the recommendation of this learning path.

© NATIONAL UNIVERSITY OF SINGAPORE

51

</> Output from LLM: Sample learning path

# KUR workflow

## How we implement in our ALS PD course

 Output formatting

 Rationale behind recommendation

\* Room for improvement

Output:

[2, 19, 22, 26, 25, 20, 5, 28, 10, 29, 1, 24]  
[1, 2, 3, 18, 19, 24, 25, 27, 28, 29]  
[2, 24, 1, 5, 25, 27, 18, 28, 19, 29, 20, 30]  
[1, 2, 18, 24, 25, 27, 28, 29]  
[3, 16, 21, 25, 1]  
[24, 19, 2, 18, 27, 3]  
[2, 18, 19, 25, 20, 26, 27]  
[2, 18, 19, 24, 25, 27, 28]  
[1, 2, 5, 19, 24, 25, 29]  
[2, 1, 5, 19, 18, 27, 24, 25]

Final Recommendation:

Selected path: 27 -> 22 -> 23 -> 20 -> 9

Rationale:

1. Cell 27 (Stakeholder identification): Vital for initiating and understanding stakeholder needs.
2. Cell 22 (Implement risk responses): Important for executing risk management strategies.
3. Cell 23 (Monitor risks): Crucial for controlling and monitoring risk responses.
4. Cell 20 (Monitor communications): Ensures effective communication throughout the project.
5. Cell 9 (Control schedule): Key for maintaining project timeline control.

This path aligns with your learner's role in ensuring safety and health in project environments and fits within your available learning time. Additionally, it covers the essential areas of stakeholder management, risk management and schedule control, which are critical for your learner's responsibilities in construction project management.

© NATIONAL UNIVERSITY OF SINGAPORE

52



# KUR workflow

## How we implement in our ALS PD course

### Project Management Online Course

Welcome back, Punyawee Anunpattana

Here is an overview of your progress and performance:

Overview Report

Start Quiz

#### Knowledge Unit Path (view your overall learning path)

##### Personalised Learning Path

Developing Project Management Plan → Monitor Communications →  
Developing Project Charter

Estimated time: 43m

\* For your learning, we recommend the estimated time to be between 2hr 30min and 3hr 30min.

### Project Management Online Course

Welcome back, Punyawee Anunpattana

Here is an overview of your progress and performance:

Overview Report

Start Quiz

#### Knowledge Unit Path (view your overall learning path)

##### Personalised Learning Path

Developing Project Management Plan → Monitor Communications → Plan Stakeholder Management → Monitor and Control Project Work & Int. Change Control → Manage Stakeholder Engagement → Close Project or Phase → Identify Stakeholders → Monitor Stakeholder Engagement → Control Procurements → Conduct Procurements → Developing Project Charter

Estimated time: 2h 35m



## Feedback from participants for KUR

- Effective in helping focus on weaknesses and engage with relevant content
- Flexibility of the path → allowing them to study at their own pace
- Want explanation of their learning path and how the learning path is structured
- Want to learn as much as they can, additional resources and learning content may be required

• “**Personalised learning path** let me skip the portion I am already familiar with and let me **focus on the one where I am weak**, which allows me to better utilise my resources.”

• “**Personalised learning path** offers opportunities and enough **flexibilities** to learn based on my own pace and **makes use of my time more efficiently**.”



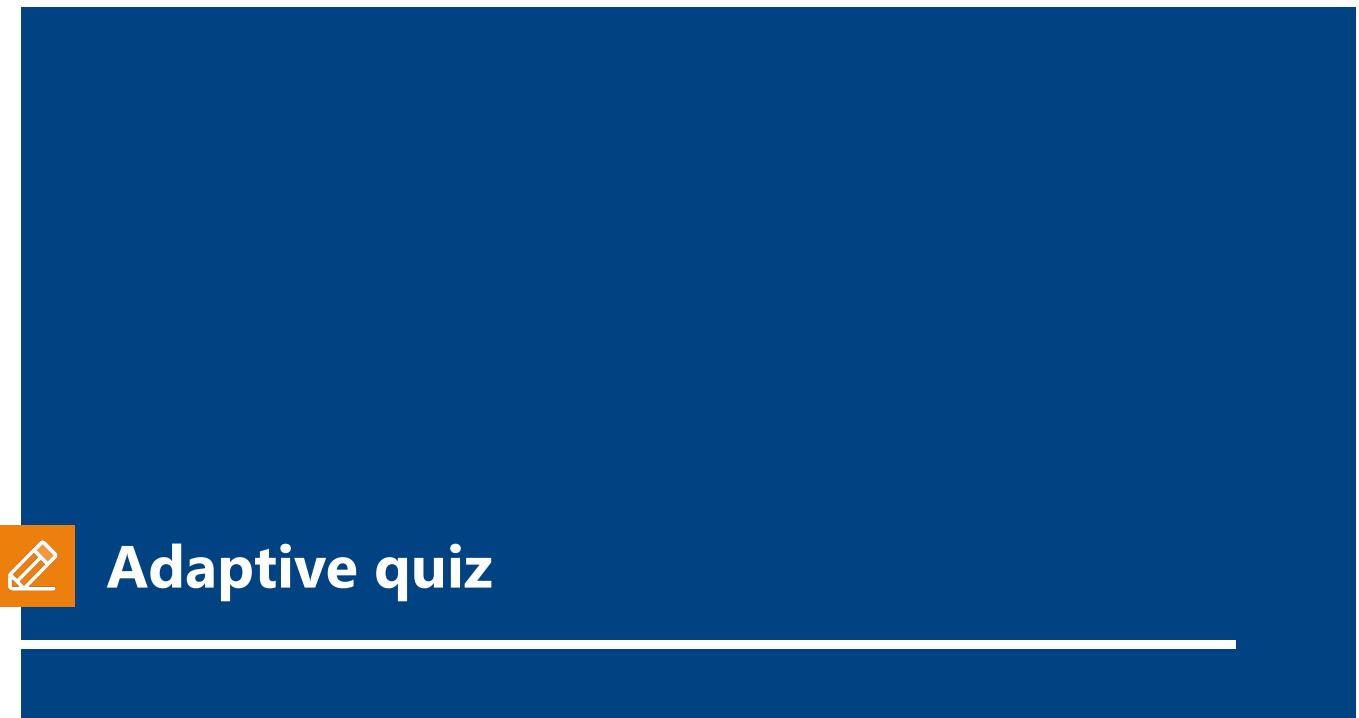
## Best practices for KUR

- Conduct pilot testing with a sample of learners
- Ensure clear and transparency in the recommended knowledge units
- Design for scalability and flexibility
- Continuously monitor and improve recommendations



## Ethical considerations

- Bias mitigation in recommendations
  - AI-generated recommendations must be free from biases based on gender, age, or background
  - Should implement fairness checks to ensure diverse and balanced recommendations
- Learner privacy and data protection
  - Implement strict data anonymisation practices, ensuring sensitive information is not exposed
  - Learner profiles should not store personal identifiers beyond what is necessary for recommendation accuracy

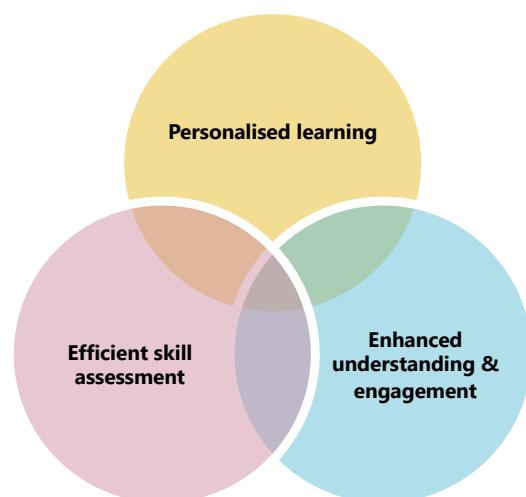


## Adaptive quiz



## Why is quizzing important?

- Targeted practice and skill improvement
- Strengthening knowledge and mastery
- Building competence and confidence

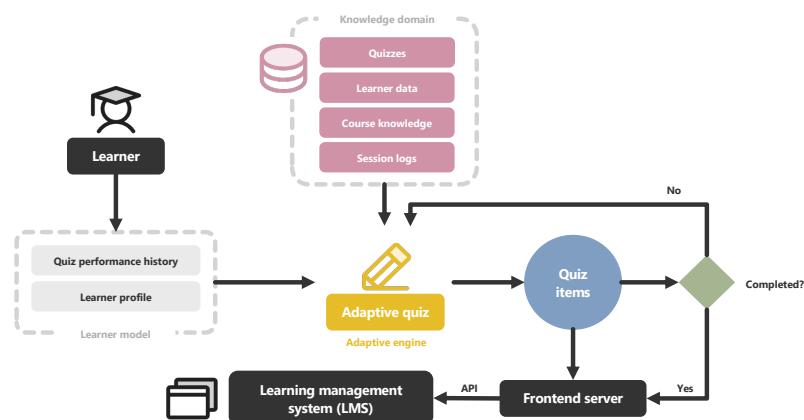




# Suggested AQ workflow

An intelligent, data-driven assessment system to select the next suitable question

- **Key component:**  
Adaptive engine
- Several approaches and application
  - *Difficulty-based*
  - *Information-based*
  - *Parameter-based*
  - *Data-driven*
  - *Exploration-exploitation*



## Key features of AQ



### Informative questions

To maximise the information gain about the learner's knowledge state, providing the most insight into the learner's understanding



### Aligning difficulty

To match the difficulty level of questions with the learner's ability, ensuring the questions are neither too easy nor too difficult



### Exploratory questions

To balance recommending or selecting questions that ensures the learner is not limited on the exploration or exploitation



# Implementation Guidelines for AQ



Database scheme and system setup



Development of quiz bank



Question selection algorithm



## Required components

- ✓ Build a diverse quiz bank
- ✓ Define pre-assessment quiz
- ✓ Map metadata to questions in the quiz bank
- ✓ Implement adaptive engine or algorithm
- ✓ Set clear quiz completion criteria
- ✓ Implement logging responses system for learning analytics



# Database scheme and system setup

Parameters	Description
User identifiers	Unique user IDs that track quiz history and mastery progress.
Quiz metadata	Storage of quiz questions, multiple-choice options, correct answers, explanations, and hierarchical categories.
Learning ability	Real-time knowledge level estimations using Item Response Theory (IRT) models.
Mastery tracking	Dynamic updates of user proficiency across topics based on responses.
Pre-test performance	Initial knowledge levels are recorded through baseline assessments.
Training data	Logs correct and incorrect answers in binary form (0 or 1) to dynamically update mastery tracking and learning ability.
User activity logs	Captures quiz interactions, timestamps, response attempts, and selected answers.

## ☰ Considerations

### Setting up an administrator site for system control and monitoring

Course developers should collaborate with educational technologists, research engineers, software developers, and LMS administrators to deploy an administration site to monitor learner progress, control system access, and update quiz content.



# Development of quiz bank

- Must be tagged with metadata
- Ensure adequate questions for each KU **[Rule of thumb: 5-min video = 3 quiz item]**
- May use LLM to generate diverse question formats



## Guidelines

Mapping questions to specific KUs

Categorising questions by difficulty

Provide correct answers and explanations

Support for multiple question formats



# Development of quiz bank

## How we implement in our ALS PD course

- Map to learning modules and cells
- Four (4) answer options
- Correct answer key
- Rationale behind answer:
  - Understand reasoning
  - Reinforce learning

mod	cell	questions	optA	optB	optC	optD	answer	rationale
2	1	Which of the following processes is typically not part of the pre-initiating phase in project management?	Defining the project's objectives and success criteria	Involve stakeholders to create a shared understanding of the success criteria	Developing the project charter	Establishing the project team and assigning roles and responsibilities	C	The project charter is usually developed during the initiating phase. It formally authorizes the project and gives the project manager the authority to apply organisational resources to the project.
3A	6	Marty, the project manager, is working with his team members to create the WBS. He shows the team how to divide the project scope into the WBS components, but the team does not understand how far down the breakdown should occur. What is the lowest-level item in a WBS?	A work package	A deliverable	An activity	A leaf object	A	The lowest item in the WBS is called the work package. A "deliverable" may be accurate, but a "work package" is a more precise answer. An "activity" is incorrect because activities are in the activity list, and a "leaf object" is an invalid WBS term.
3A	6	You will use the scope management plan to define the project scope statement. You will also use this plan to build the scope baseline. Which two items are parts of the scope baseline for the project?	Time and cost baselines	The project scope management plan and project charter	The project scope management plan and the WBS	The WBS and WBS dictionary	D	The WBS and WBS dictionary are two of the three components of the scope baseline. The approved detailed project scope statement is the third portion of the scope baseline. The other options are all incorrect because they do not accurately define the scope baseline.
4A	3	You report on project elements such as schedule status, deliverables completion, lessons learnt, and resource utilisation. Which of the following outputs of the Direct and Manage Project Work does this describe?	Project management plan updates	Project documents updates	Preventive action	Work performance data	D	Work performance data includes elements such as schedule status, the status of deliverables completion, lessons learned, and resource utilization.



# Development of quiz bank

## How we implement in our ALS PD course

- Uploaded lecture transcripts and handouts to LLM
- Prompt it to create relevant quiz items

### </> LLM prompt: Generating quiz bank

From the uploaded transcript (05b-03), developed five (5) high-order thinking multiple choice questions. Please craft the questions for adult learners and make it as a construction context and can refer to project management references.

Make each question a case study where the learners are project managers in construction context where learners can apply concepts. Each question should have 4 options. Highlight the correct answer.

Provide an explanation for the correct and incorrect options. Write in GB English. Make it questions difficult. For the explanation, please write in one paragraph for each question. Start with the correct option and state that "the other options are wrong because..."



# Question selection algorithm

Relyes on advanced algorithms to adjust the difficulty dynamically and select optimal questions

## Item Response Theory (IRT)

## Bayesian Knowledge Tracing

## Reinforce Learning-Based Adaptive Quizzing

## Knowledge Graph-Based Adaptive Quizzing

- IRT is most common method
- Presents new question parameters based on learner performance
- As they progress, the system updates their ability levels
- Provides well-matched questions whether to reinforce familiar concepts or introduce new challenging topics.



# Question selection algorithm

## How we implement in our ALS PD course

User interface of our AQ system showing the quiz question and options, with immediate feedback feature, highlighting the rationale behind the chosen option.

the budget has already been spent. What does this indicate about your project's status?

- Option A: The project is ahead of schedule and under budget.
- Option B: The project is ahead of schedule but over budget.
- Option C: The project is behind schedule but under budget.
- Option D: The project is on schedule but over budget.

### Result: Correct

The project is ahead of schedule (40% completed vs. 38% planned) but over budget (50% spent vs. 40% work done). Thus, the correct answer is 'The project is ahead of schedule but over budget.' The other options do not correctly describe both the schedule and budget status.

Next

Allows users to adjust the exploration parameters, time duration, total number of questions, and topic(s) they want to practice in the quiz based on their preferences

Save settings and start the quiz

Settings

Exploration vs Exploitation ⓘ  
Drag the slider to set your preference between exploring new knowledge and exploiting what you're good at.

Highly Exploration      Highly Exploitation

Timer Configuration ⓘ  
Choose the timer duration for the quiz.

10 minutes      minutes

Maximum Number of Questions ⓘ  
Choose the total number of questions in a single quiz session.

10      questions

Knowledge Units (KU) Configuration ⓘ  
Choose the KU(s) that you want to practice or included in this quiz.

Cell 1: Developing Project Charter      Cell 2: Developing Project Management Plan

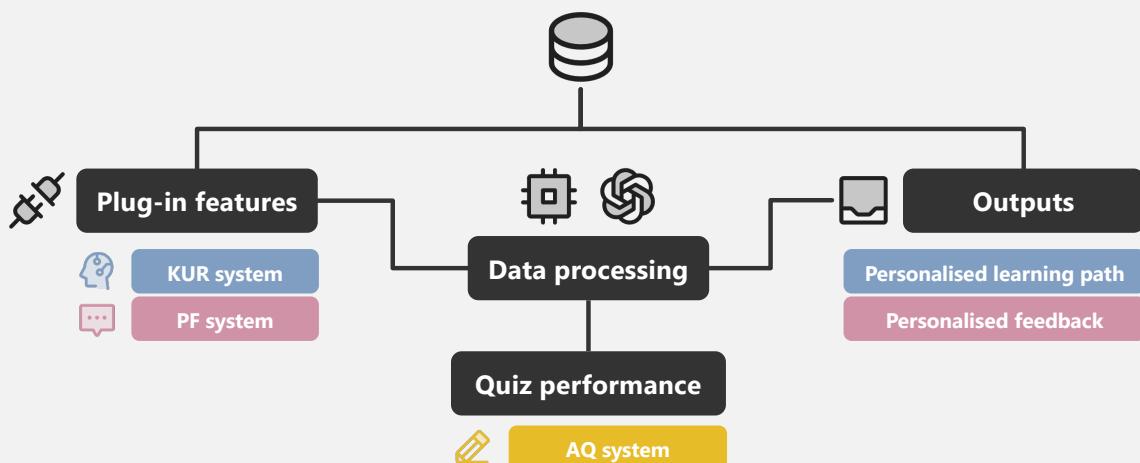
Randomly picked KU (unselect if you want to customise)

Add KU



# Integration with other adaptive features

Allowing for seamless connection for better experience



# Integration of AQ to Canvas LMS

How we implement in our ALS PD course

Home  
Adaptive Learning  
AWS  
Announcements  
Assignments  
Discussions  
Grades  
People  
Pages  
Files  
Syllabus  
Outcomes  
Rubrics  
Quizzes  
Modules  
BigBlueButton  
Collaborations  
New Analytics  
Google Drive  
Chat  
Studio  
Microsoft Teams  
Classes

**Adaptive Quiz**  
Introduction to Project Management  
Welcome back, Punyawee Anunpattana  
Here is an overview of your progress and performance:

Start Quiz

Knowledge Unit Path (view your overall learning path)

Personalised Learning Path

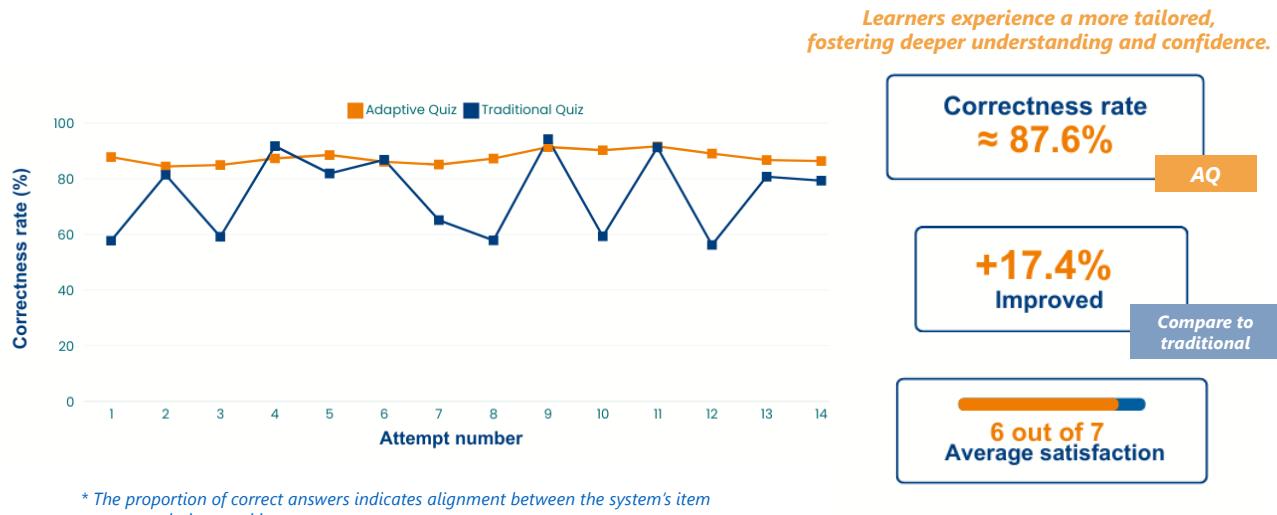
Control Costs → Control Procurements → Plan Risk Management, Analysis and Response → Plan Stakeholder Management → Conduct Procurements → Plan Quality Management

Estimated time: 2h 34m

## Evaluation Activity Result



# Effectiveness of Adaptive Quiz



## Feedback from participants for AQ

- Helps focus on areas of improvement
- Review knowledge within time limit
- Can use this as a learning tool to:
  - Practice on specific topic
  - Help understand unfamiliar concepts and terminology
  - Build both competence and confidence
- Provide meaningful re-attempting and avoid repeated questions
  - More real-world scenarios or relevant to more specific job roles
  - Needs of automatic question generator
- "It is a **good tool to practice**; I attempted many times to gain knowledge and reach a higher score as much as I can."
- "Adaptive quiz can help **gain self-confidence** before post-quiz because I feel **understanding more**."
- "**Very helpful to review my knowledge**, we don't want to sit down for 5 minutes... it's not suitable for part-time learners."



# Considerations

Common issues that course developers may encounter when adopting the AQ

## Main Challenges

### Real-time Item parameters

- Item parameters are dynamically updated every quiz session, require extensive resources

### Repetitive questions

- May initially receive similar or redundant questions, require large quiz bank

### Exhausted questions

- Ensures continuous learning opportunities even for advanced learner



# Best practices for AQ

- Ensure balanced question difficulty to progressively challenge learners without causing frustration
- Implement an intelligent question rotation system (i.e., session tracking and learner history) to prevent learners from repeatedly encountering the same questions
- Deliver meaningful and immediate feedback to help learners identify knowledge gaps and offer tailored recommendations for improvement
- Expand and refine the question pool to ensure continuous improvement



**Before we proceed to the  
next section, do you have  
any questions?**



**Personalised feedback**



## Why feedback?



## Why personalised feedback?



### 1 Addressing individual needs

- Learners have different backgrounds, roles, and experience levels
- Personalised feedback recognises these differences



### 2 Enhanced engagement

- Tailored messages keep learners more motivated than generic “one-size-fits-all” comments



### 3 Better retention and performance

- Specific next steps and resources lead to more meaningful skill acquisition and real-world application



## Key features of personalised feedback



### Data-driven insights

Utilises quiz logs, assignment records, forum engagement, page views, and learner profiles



### LLM-aided generation

Employs Large Language Models (LLMs) to craft context-aware, learner-specific responses



### Adaptive and scalable

Supports multiple learners with consistent, high-quality feedback



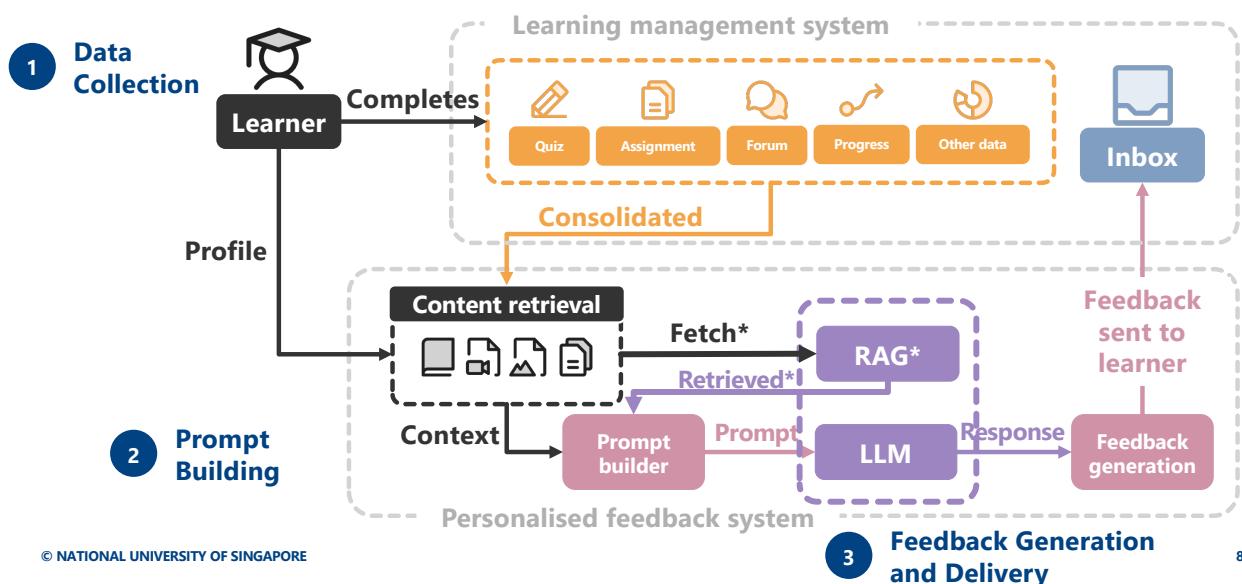
### Customisable delivery

Via LMS messaging, email, or enterprise chat systems based on organisational preferences



## Personalised feedback workflow

An end-to-end, automated system transforms raw learner data into tailored, actionable insights





# Implementation Guidelines for PF

Collecting and preparing learner data

Designing effective prompts for personalised feedback

Tone and style considerations

Creating actionable feedback

Automatic personalised feedback delivery

Evaluation and continuous improvement

## Collecting and preparing learner data

Quiz and Question-Level Data	
<b>Objective</b>	Identify specific questions answered correctly or incorrectly, record responses, and match them with correct solutions and rationales.
<b>Typical LMS Access</b>	Export quiz result logs via CSV or use an LMS API endpoint to gather attempts, timestamps, scores, and detailed responses.
<b>Processing</b>	Map each question to its correct solution and rationale. Maintain a record of how many questions each learner answers correctly or incorrectly, and on which attempts.
Assignment Data	
<b>Objective</b>	Determine submission status, timeliness, and grades for each assignment.
<b>Typical LMS Access</b>	Retrieve assignment lists, deadlines, user submissions, and grading details from your LMS.
<b>Processing</b>	Collate each learner's submission dates, highlight if any are late or missing, and note scores or rubrics. Identify patterns (e.g., consistent tardiness, certain rubric criterion not met).

Discussion and Forum Engagement	
<b>Objective</b>	Assess both quantity and quality of participation.
<b>Typical LMS Access</b>	Use discussion-topic endpoints or CSV exports that include each learner's posts, replies, timestamps, and thread participation.
<b>Processing</b>	Count overall posts, detect how many are made weekly, and whether they reflect constructive engagement. Optionally, examine content for length and relevance.
Page Views and Session Data	
<b>Objective</b>	Understand which resources the learner accesses and how frequently.
<b>Typical LMS Access</b>	Many LMSs provide analytics endpoints or summary pages showing hits and participation data.
<b>Processing</b>	Summarise total page views, time spent, and whether learners engaged with recommended modules or topics.
Learner Profile Data	
<b>Objective</b>	Provide personalised context (e.g., job role, years of experience, learning preferences).
<b>Typical LMS Access</b>	Admins can store additional attributes (e.g., from pre-course surveys) and retrieve them.
<b>Processing</b>	Merge profile data such as preferred feedback length or day to tailor both the style and schedule of the feedback.

# Designing effective prompts

- Include assignment, background, and learning objectives
- Balance encouragement with constructive criticism in feedback
- Provide rubrics and structured feedback instructions
- Highlight strengths, improvements, and actionable next steps



## Guidelines

**Start with a clear system message**

**Provide detailed context**

**Give structured instructions to guide AI**

**Specify detail level**



# Tone and style considerations

- Maintain a professional, supportive tone to encourage growth
- Acknowledge effort while providing clear improvement steps
- Avoid casual or authoritative tones
- Use active voice, specific examples, and transition phrases for clarity



## Guidelines

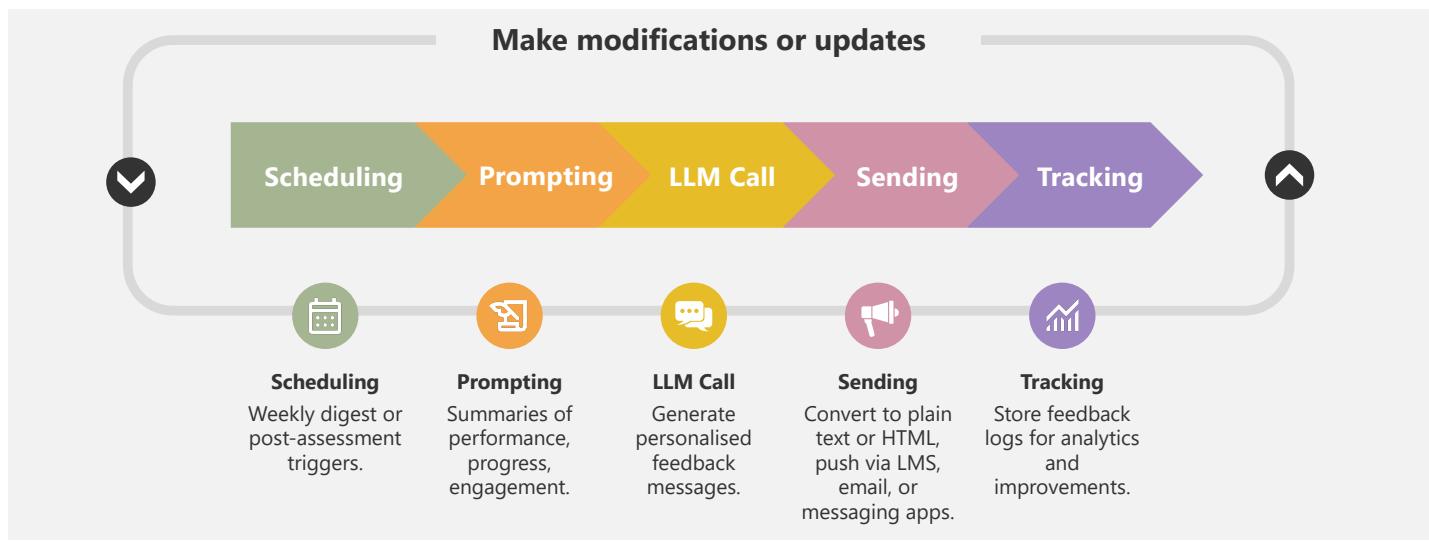
**Use a supportive and respectful tone**

**Be specific by referencing part of learner's work**

**Avoid overly generic statements**



# Automating feedback delivery



# Evaluation and continuous improvement

- Continuously evaluate feedback system using quantitative and qualitative metrics
- Use student feedback to refine prompts and improve clarity
- Adjust tone, language patterns, and feedback structure based on data

## ☰ Considerations

**Creating opportunity for learner feedback through post-feedback micro survey, end of course evaluation, focus groups and interviews.**

Metric	Examples	Collection Method
Student Engagement	Discussion participation, assignment completion	Automated tracking
Learning Outcomes	Grade improvements, skill development	Performance analysis
User Satisfaction	Feedback utility, clarity ratings	Student surveys
System Performance	Response time, accuracy	Technical monitoring

 PM5101 Teaching Team,  
PM5101 Project Management [2420]  
21 Feb 2025 at 12:04

Dear ,

## Example

### How we implemented it

Great work on your steady progress in the course! 🎉 Your early submission of quizzes and strong scores in the Module 03A and 03B quizzes show great dedication. Your structured approach to project management concepts is commendable and aligns well with your background in industrial and management engineering.

#### What You Did Well:

- ✓ Excellent consistency in keeping up with assignments. Submitting on time and scoring full marks on recent quizzes highlights your understanding of core planning processes.
- ✓ Strong engagement with module materials. Your completion of all required materials for Modules 1 to 3B demonstrates an organised approach to learning.
- ✓ Prior project experience is an asset. With 11-15 projects under your belt, your ability to apply theory to real-world scenarios is a strength—consider sharing insights in discussions to enrich learning for yourself and others.

#### Areas for Improvement:

- ◆ Module 3C & 3D Progress - These modules are crucial for understanding resource, quality, risk, and procurement management. Given your role in manufacturing, these concepts directly apply to product design and development. Prioritise completing the readings and quizzes to stay on track.
- ◆ Discussion Forum Engagement - You've shared insights in the Project Charter discussion, but more participation would be beneficial. Engaging in the Quality, Resource, and Stakeholder discussions would allow you to relate course concepts to manufacturing challenges.
- ◆ Handouts & Additional Resources - The Module 03B and 03C handouts are pending. These documents provide structured frameworks useful for both the course and practical application in your role. Try incorporating them into your reviews.

#### Next Steps:

- 👉 Aim to complete Module 03C and 03D materials by early next week. This keeps you aligned with the course pace.
- 👉 Engage in at least one discussion thread. Sharing your manufacturing sector experience in project risk or quality management will strengthen your learning and help others.
- 👉 Reflect on how resource planning applies to your current projects. How do you balance quality, resource constraints, and stakeholder needs?

Keep up the great work! Your strong foundation will be invaluable in the upcoming execution and monitoring modules. Let us know how else we can support your learning 😊.



## Feedback from participants for PF

### What adult learners like about PF

- "The first sentence that commended me makes me want to do better in the next quiz."
- "I appreciate it very much... because that way I can directly relate where are my weak points and I can go and improve on that weak point."
- "Knowing that the feedback was tailored to me made me more invested in the learning process."

### Motivational Impact

### Point out strengths and weaknesses

### Personalisation



## Feedback from participants for PF

What adult learners **want** for their feedback

- "It would help if the feedback included practical scenarios so I could see exactly how to apply what I've learned."
- "To me, it's a bit wordy... If it can be more concise and condensed, then it'd be better."

- Practical scenarios
- Conciseness

</>

**Hands-on demonstration:  
Generate your own personalised feedback**



## Objectives



Understand how prompt can be built from data



Explore how prompt adjustments affect the feedback



Experience the basic workflow of AI-driven feedback



## Exploration Activities

- **Task 1** Modify the learner and observe how feedback is personalised for different learners
- **Task 2** Modify the tone of the feedback and observe how feedback changes
- **Task 3** Add your own instructions to improve the feedback
- **Reflection**

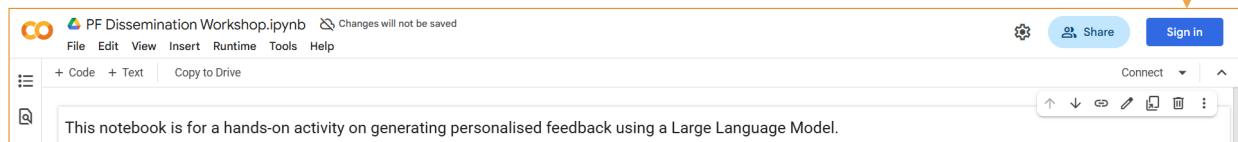


## Google Colab Notebook

- Key in the URL in your computer browser

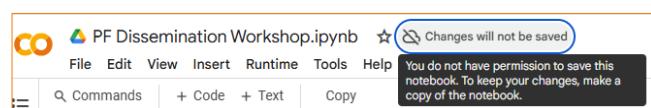
**bit.ly/workshop-pf**

- Click “Sign in” to use the notebook

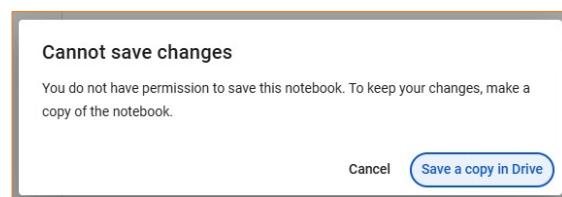


## Make a copy of the notebook

1. Click “Changes will not be saved”



2. Click “Save a copy in Drive”



3. Wait for a moment and you should have a copy now!





# Exploration activities

## Task 1: Modify the learner

1. Go to Cell 3 and locate this line
2. Change the Learner Profile by replacing 7 with another number

# Select a learner for demonstration  
row\_index = 7 # Change this index to test different learners

Sample Learner Profiles:											job_role	industry
	learner_name	assessment_score	focus_area	quiz_attempted	quiz_correct	quiz_score	assignment_status	forum_posts	engagement_level	progress	job_role	industry
0	Mark Lee	68	Presentation Skills	10	7	70	Completed	5	Active	80	Team Lead	Marketing
1	Angela Tan	82	Data Analysis	12	10	83	Pending	12	Highly Engaged	95	Analyst	Finance
2	Priya Patel	55	Critical Thinking	8	4	50	Overdue	0	Inactive	40	Student	Education
3	Luis Gomez	90	Leadership Strategies	15	14	93	Completed	8	Moderately Engaged	99	HR Manager	Human Resources
4	Sophia Khan	73	Time Management	11	8	75	Pending	3	Passive	70	Project Manager	IT
5	Daniel Osei	60	Communication Skills	9	6	65	Overdue	6	Active	55	Trainer	Corporate Training
6	John Tan	50	Site Safety Compliance	7	5	55	Completed	2	Passive	45	Site Supervisor	Construction
7	Emily Wong	77	Project Management	10	9	80	Overdue	4	Moderately Engaged	82	Construction Manager	Construction
8	Carlos Rivera	85	Structural Analysis	12	11	88	Pending	7	Highly Engaged	90	Civil Engineer	Construction
9	Aisha Malik	62	Workplace Efficiency	6	4	60	Completed	1	Low	50	Skilled Worker	Construction

3. For example, try Carlos Rivera
4. Run Cell 3 and observe how the prompt changes
5. Then run Cell 4 and observe how the feedback changes



# Exploration activities

## Task 2: Modify the feedback style

1. In Cell 3, change the style
2. Try new styles like "casual", "strict", "motivational", or any creative words.
3. Run Cell 3 and then Cell 4
4. Observe how the feedback changes

style="encouraging" # Change the feedback style to formal, casual, friendly, or neutral, etc.



# Exploration activities

## Task 3: Add your own instruction

1. In Cell 3, add your customised feedback prompt by typing "6."

```
"Please include:\n"
    "1. A short motivational note based on the learner's progress and engagement level.\n"
    "2. At least two personalised, actionable tips for improvement.\n"
    "3. If the assignment is pending/overdue, offer encouragement and prioritisation tips.\n"
    "4. Keep the response within 100 words.\n"
    "5. Use short, punchy bullet points and emojis.\n"
    "6. |"
```

```
)\n\nreturn prompt
```

2. Alternatively, modify the existing points
3. Run Cell 3 and then Cell 4

### Examples:

Change the number of tips from 2 to 3 or add “Use a motivational quote at the end.”



## Reflection questions

- How might you integrate personalised feedback into your training context?
- What other learner attributes or data would you want to incorporate?
- Which “styles” of feedback felt most appropriate or engaging?



[pollev.com/xinpingh](https://pollev.com/xinpingh)



## Summary

- Personalised Feedback to boost engagement and guide individual learners
- Gather data → Build prompts → Use LLM for feedback → Deliver & refine
- Simple parameter changes (e.g., learner context, style) shape responses

### Next steps:

- Use learner data (quiz scores, roles, etc.) to create the prompt
- Track learner outcomes, iterate on prompts, and add more data points



**Let's summarise what we have presented today.**

## Recap of the session

1. Introduced the study overview, aims and objectives, project stages
2. Introduced the Toolkit, key considerations, and how to use it
3. Introduced the key adaptive features, key findings and best practices
4. Demonstrated how to implement personalised feedback using LLM

Stage 1: Preliminary

## What we have done

- ✓ Examine the current state of AL adoption and views towards AL
  - Conducted surveys, interviews and focus groups with adult learners and trainers
- ✓ Identified top three AL features rated by adult learners and trainers
  - Personalised feedback (4.04)
  - Adaptive quiz (3.88)
  - Knowledge unit recommender (3.83)

## What we have done

- ✓ Conducted quasi-experiment on vendor-based commercialised ALS
  - Found that
- ✓ Develop our own ALS prototype based on the top three AL features and feedback (KUR, AQ, and PF)
  - Conducted user acceptance tests and pilot studies to gather feedback

## What we have done

- ✓ Refinement on ALS based on feedback from Stage 2
- ✓ Conducted quasi-experiment
  - Measured effectiveness through pre-post test, perception survey, interviews, and focus group discussion

## What are the challenges of ALS for PD?

Regardless if you developed your own ALS or employed commercialised platform, one of the key challenges of ALS for PD is that it is **resource intensive**.

- Development of knowledge unit/ content materials
- Integration requirements with LMS
- Need to track constantly
- Need to be agile to adapt to changes



## Q&A session



Please raise your hand when you are done for us to distribute the voucher.



## Post-questionnaire



<https://bit.ly/al-qnr>



Thank you for attending this workshop.

Feel free to contact us for any questions related to the workshop or the project.



[bdgbox34@nus.edu.sg](mailto:bdgbox34@nus.edu.sg)



<https://cde.nus.edu.sg/dbe/cpfm/sarru/>



Please remember to sign out to get your \$40 voucher.