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April 26, 2023

CikguHub: an accessible AI-driven talent development platform for Malaysian teachers

1. Introduction

Teacher development is a never-ending journey. As the landscape of education continues to evolve with new perspectives and technologies, teachers must continuously learn, adapt, and grow to provide high-quality education to their students. Therefore, the goal of teacher development should go beyond maintenance and create sustainability and professional longevity [1]. Despite the importance of teacher development, teachers in Malaysia are not receiving sufficient professional development, as evidenced by the fact that 83% of them feel this way [2]. And 69% of them highlighted that their current professional development activities are boring and time-consuming [2]. In 2021, a survey on Malaysian teachers' professional development has shown that teachers have difficulty knowing their areas of improvement, finding high-quality learning materials to improve their skills, and getting feedback for their work.

To fill the gaps in teacher development, Edvolution was founded as a not-for-profit social enterprise that focuses on leadership development and people empowerment in the Malaysian education system to drive institutional reform. It works closely with the Malaysian Ministry of Education with the mission of "building transformative leaders, competent educators, and effective community builders in schools" [3]. In addition, the Malaysian Ministry of Education has set "Learning and Facilitation Standards" for teachers to not only improve classroom performance but also enhance student engagement and success. The standards include teachers

as planners, guardians, mentors, motivators, and assessors [4]. To help teachers develop their skills in each competency area, Edvolution initiated various projects and programs. However, there is no one centralized learning and development platform that provides access to these programs and projects. And administrators in Edvolution and government officials have trouble assessing teachers' competencies at scale and managing teaching resources.

Partnering with Edvolution and using its resources and platform, CikguHub would help solve these problems by using human-AI partnerships to recommend personalized learning materials and generate competency scores and feedback. "Cikgu" means "teachers" in Malaysian. Based on the teachers' current experience, skill level, and learning needs, the AI in CikguHub would recommend suitable learning tracks. As the teachers learn from the contents and answer the reflection questions after each session, AI would also use these metrics to evaluate the teachers' competencies and provide feedback. Meanwhile, a group of experts from Edvolution would verify and improve the AI-generated report and recommendation, forming a human-AI collaboration.

As for the long-term significance of the project, the Malaysian Ministry of Education aims to create "Scholarly Teachers", who have the drive to learn and take the initiative to up-skill themselves. However, professional development in the eyes of Malaysian teachers is often long, not engaging, and does not meet their needs. On top of that, the Ministry is working towards allowing greater school-based management, giving schools the autonomy to manage areas such as teacher development (previously being federally driven). Schools, however, are finding it hard due to the lack of knowledge and resources in this area. The vision of the project is to develop and support the Ministry to achieve its aspiration of creating "Scholarly Teachers". We also aim

for schools to have a comprehensive talent development and performance management system through our platform.

I developed CikguHub with a team of 4 other students, Christopher Kok, Gregory Croisdale, Anmol Mansingh, and Jacquelyn Schmidt. However, all four of them are not in the College of Engineering Honors community. Through collaboration, we developed the Minimum Viable Product of CikguHub, which required various steps in different areas of study, such as learning, designing, and refining Machine Learning clustering, human-AI system, and the front-end and back-end of web development. For the purpose of this report, I would focus on my individual contributions, which were researching, designing, and implementing:

- the system and user interaction model,
- the UI/UX of the report generation parts of the website,
- and the responsiveness and accessibility of the website.

2. Problems Addressed

Our need-finding process was interviewing the key stakeholders at Edvolution because they have done extensive user studies with teachers in Malaysia and have insights on the challenges faced by educators and the support needed. We were interested in learning and detailing their process. We interviewed Melissa Gomes, who is the CEO, Janice Chong, who is the Programme Director, and Ken Khoo, who is the Brand and Marketing Lead. We found that the need for report generation stems from:

1. the lack of technology for administrators and government officials to assess teachers' competencies at scale,
2. the incapacity of administrators and government officials to manage teaching resources,

3. and the insufficient feedback for teachers to know their areas of professional improvement.

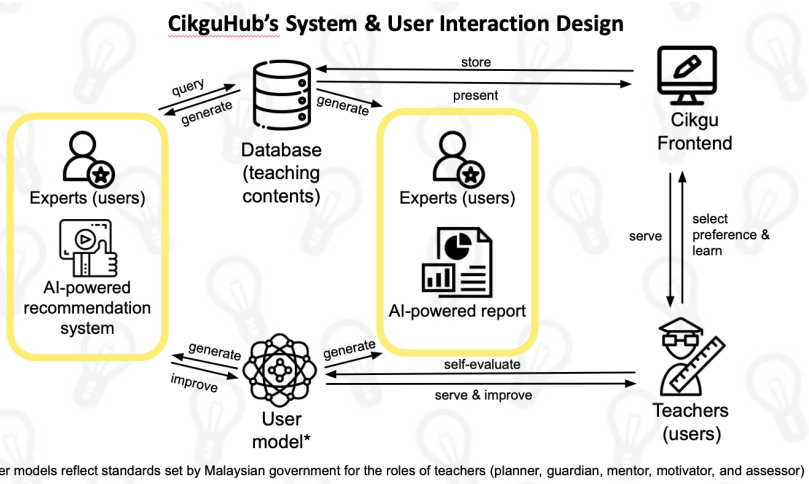
The need for content recommendation stems from:

1. teachers' inability to efficiently search for high-quality learning materials that meet their specific needs,
2. teachers' struggle to stay engaged with the vast amount of content available, and
3. teachers' difficulty in comprehensively understanding the material that is made for multiple levels of expertise.

CikguHub will address all the problems above. The primary objective of the project is to develop CikguHub as a responsive, accessible website that incorporates the recommendation system and report generation, which are both powered by the human-AI partnership.

3. Methodology and Result of the System and User Interaction Model

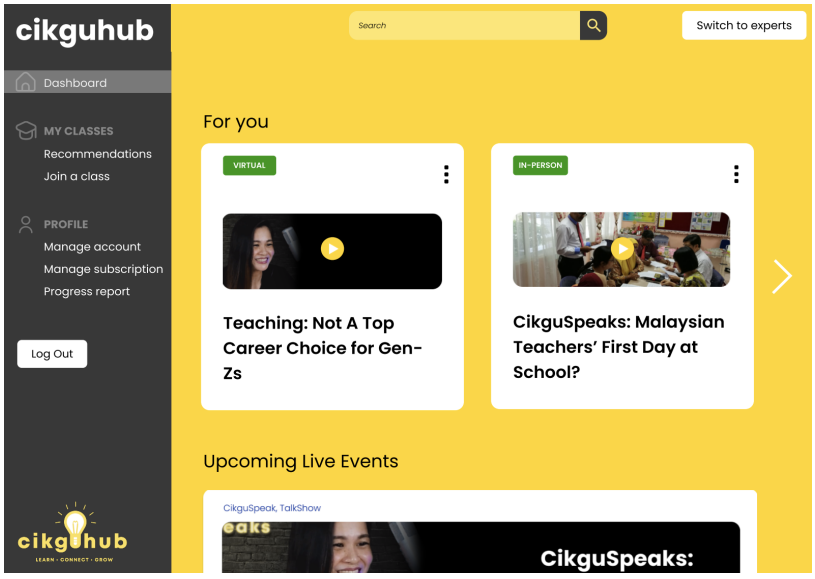
The system and user interaction model shows how individual components of CikguHub work together. It also shows how users would interact with the whole system. To obtain the model, I first brainstormed the individual components needed for CikguHub, initiated the topics/questions that the team as a whole needed to think about and discuss, and created a rough draft on Google Slides. Then, I led and drove an all-hands team meeting to finalize the model, which is shown in Figure 1.



The individual components of CikguHub are a database, front end, user model, human-AI partnership for content recommendation, and the other partnership for report generation. I arranged the two human-AI partnerships in the middle of the model to emphasize these are the main components and the competitive values of CikguHub. The model is a close loop, meaning to illustrate that as teachers engage more in the learning materials on the website, the AI has more metrics to better understand them and more accurately recommend the learning materials. As the experts verify or improve the AI-generated results more, the AI would better match its prediction to the label in the Machine Learning clustering, creating a virtuous feedback loop.

4. Methodology and Result of the UI/UX of Report Generation

Since CikguHub has two main parts, the content recommendation and the report generation, I would be responsible for the UI/UX of the report generation and Anmol would take charge of the UI/UX of the content recommendation. To design the UI/UX, I first researched and understood the user behavior, making the design human-centered. I learned from Edvolution's administrators that most Malaysian teachers are not tech-savvy. They would easily get confused when completing a task requires too many buttons and when there are hidden buttons. So when I designed the UI/UX on Figma, I decided to have a navigation panel that lists all the web pages the teachers can navigate to (Figure 2).



Additionally, since the website would serve two groups of users — teachers and experts, the report generation page would function differently. For the teachers (Figure 3), I used sliders to visually illustrate the teacher's score/progress in each competency area. Teachers would also see the personalized notes from the AI-experts collaboration. For the experts (Figure 4), the sliders and notes are not only viewable but also editable, allowing the experts to verify or improve the AI-generated result based on the teacher's profile.

Figure 3. Teachers' View of Report

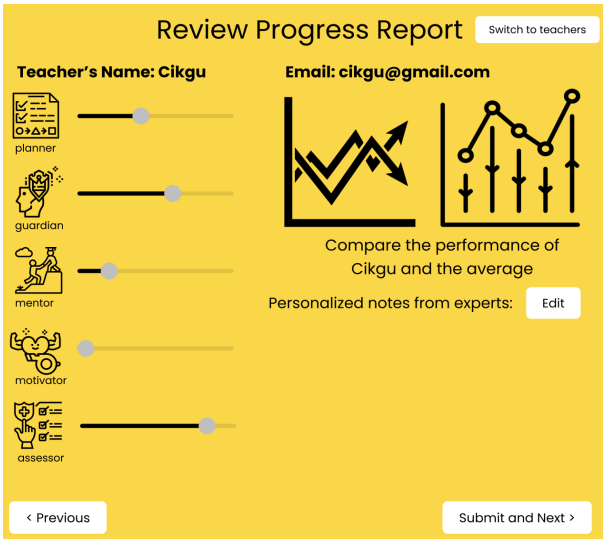


Figure 4. Experts' View of Report

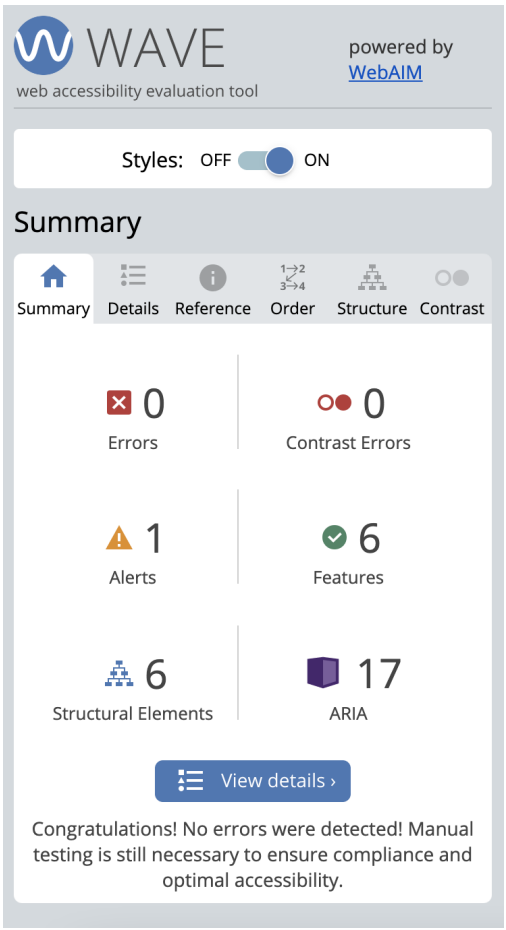
Besides designing the UI/UX on Figma, I also frequently synced with Anmol to ensure that all design elements are consistent and the user interaction flow is intuitive, seamless, and engaging. Then, Anmol and I improved the design through two iterations of asking interviewees to use the Figma prototype, collecting feedback, and implementing the refinement. Once we finalize the Figma prototype, I implement the front end of the report generation using Javascript, HTML, and CSS. The Figma prototype for the entire website is https://www.figma.com/file/AlKohOnlX0RHYIEXfXikv3/Cikgu-Frontend?node-id=0%3A1&t=wgVNUELCSWvWuDxr-1. The GitHub repository that stores all the Javascript, HTML, and CSS code is https://github.com/chriskok/cikguhub.

5. Methodology and Result of the Responsiveness and Accessibility of the Website

Ensuring website responsiveness and accessibility serves to broaden its inclusivity, rendering it truly accessible to *everyone*. Responsive Web Design (RWD) is a set of practices that allows web pages to alter their layout and appearance to suit different screen widths and resolutions. To implement responsiveness, I used a responsive design framework, Bootstrap, which provides pre-built HTML, CSS, and JavaScript components for creating responsive web designs. I also used CSS media queries to adjust the layout and styling of web pages based on the device screen size and resolution. When suitable, such as the five sliders on the report web page, I implemented a flexible grid system that adapts to different screen sizes and enables content to be rearranged to fit the available space. Meanwhile, I also used the "Inspect Elements" functionality on Google Chrome to test if all the HTML elements on every web page display correctly and function properly. If not, I edited the CSS style of the elements or change the HTML element completely to achieve responsiveness.

Web accessibility means that the website is accessible to individuals with disabilities or impairments. Web Content Accessibility Guidelines (WCAG) and the POUR principles (perceivable, operable, understandable, and robust) are the protocols that I followed to ensure accessibility. For example, I used semantic HTML markup to ensure that content is structured correctly and can be interpreted by screen readers and other assistive technologies. I provided alternative text descriptions for images, videos, and other non-text content and ensured the website has sufficient color contrast between text and background so that users with visual impairments can read the content easily. I also ensured that all interactive elements on the website, such as buttons and links, are easily navigable using a keyboard, as some users may not be able to use a mouse. Meanwhile, I used WAVE and axe DevTool, both of which are web

accessibility evaluation tools, to test if every web page on CikguHub is compliant with WCAG and follows the POUR principle. Figure 5 shows an example of a web page passing the WAVE test, and Figure 6 is that of passing the axe DevTool test.



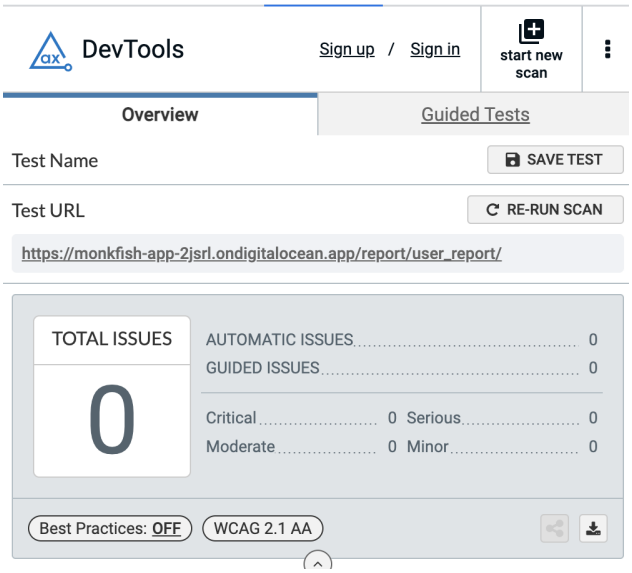


Figure 5. An example of passing WAVE Figure 6. An example of passing axe Dev Tools

6. Evaluation

Our evaluation involved two kinds of users of our human-AI interface – users with teaching experience and experts who are in Edvolution. We were interested in getting feedback on the functionality and usability of Cikguhub, specifically about the AI-generated feedback, the recommended content, and user retention, by investigating the following key questions.

6.1. Key Questions for Users and Experts

- How do users feel about AI Automated feedback?

    - Is it as meaningful if a human approves what an AI has written VS a human editing an AI's feedback VS a human writing the feedback fully
- How does the user feel about the recommended content and the way it's displayed?
- How is the user's retention? Can we do more to improve their focus?
- What design considerations can we implement to improve the platform for users?
- Would you be more likely to use this system as opposed to Coursera? Khan academy? YouTube?

6.2. Key Questions for Experts only

- Is it clear how to edit user clusters and what the various controls do?
- Is there something you want to do that you can't?
- Do the clusters make sense?
- Do the recommendations for the clusters seem reasonable? Could the recommendations be better?
- How much do you anticipate supervising the automatic recommendation system? Do you see yourself changing the clustering often? Do you anticipate checking it once in a while? Every day? Never?
- What sort of situations can you think of where the recommendation system would fail/produce a bad result?
- In general, do you think the AI report does a good job?
- What should be considered when choosing specific responses as input to the report generator?
- How could the interface change to give the expert more control over report generation?
- How might we utilize AI tools to help teachers understand their progress more?

- Is it appropriate to individualize report styles depending on the user? I.e., User A prefers direct feedback, etc.
- Could you imagine a system where an AI report is directly given to an end-user without necessarily going through an expert first?
    - If so, what would need to change?
- How else can expert workload be reduced/made more effective?

6.3. Evaluation Method

We recruited three user participants with teaching experience (including contacts from the School of Education at the University of Michigan). Two expert participants were recruited from the group of CikguHub founders; these experts also assisted us in the need-finding stage of the project.

We also designed and followed a semi-supervised, structured interview about their experience on the platform. The interviewees completed a series of tasks from creating an account, to watching a video and answering questions, to reading/editing the report. Meanwhile, we observed the interviewees' behaviors on the website. Then, we asked the questions above to learn about the functionality and design of the website, and eventually evaluated the effectiveness of CikguHub.

6.4. Analysis

We gathered user comments and utterances during the study and collected them into an Affinity Diagram (Figure 7), organizing the different feedback by category. The raw data is available here: CikguHub: Final Evaluations

Figure 7. The Affinity Diagram of User Evaluation

7. Evaluation Findings

7.1. The Effectiveness of AI-generated Feedback

AI-generated feedback has the potential to benefit significantly teachers by providing detailed feedback. Users were generally satisfied with the quality of the generated reports. Experts emphasized the importance and high cost of individual feedback – without AI, this type of feedback is prohibitively expensive. The experts were excited by the example of auto-generated reports they saw, particularly because they have had difficulty providing targeted feedback to users in the past, they said.

Users may want to provide feedback on the feedback they've been given. If a user gets feedback that they don't agree with, they might want to submit a comment, similar to the functionality available on Canvas. This could be addressed autonomously, like the report is initially generated, or perhaps must be adjusted with direct expert intervention.

7.2. The Effectiveness of Machine Learning Clustering

The user clustering interface needs to be better aligned with the technical proficiency of the experts, who are non-data scientists. There are a number of different ways that these clusters could be utilized, but they need to be implemented.

Experts thought that the clustering made sense and seemed to be separating users in a useful and logical way. As of right now, while the hard part of clustering has been implemented, the interface lacks proper explanations and the experts were unsure how they should go about changing the clustering parameters. In particular, they were unsure what the effect of choosing a different number of clusters was and tended to choose a small number of features to classify, which is not necessarily the best data science practice. In future work, we need to carefully consider how to encourage the experts to make good decisions as they edit clusters.

It was unclear whether experts would be able to get the best use out of the clustering functionality. The experts were excited by the prospect of using clustering to visualize the data and qualities of the users. In particular, they expressed that clustering would be an effective tool to present their findings to the Malaysian Ministry of Education and to determine directions for new content development.

7.3. The Quality of the UI/UX of the Website

The interface is functional and effective, but a few minor changes could greatly improve the user and expert experience. Many user and expert comments were regarding issues navigating basic portions of the interface. For example, the labels explaining what different standards mean should always be at least partially visible, rather than only when someone is hovering over the logo.

More work needs to be done designing the numerical portion of a user report – Teachers may be more familiar and comfortable with a rubric-style approach. Although grades are often on a

scale from 1-100, experts indicated that individual grades are often more efficiently assigned with the use of a rubric rather than an arbitrary scale from 1-100. With the inclusion of such a rubric, teachers may have a better idea of how to write their responses so that they will get the score they desire.

7.4. Overall Effectiveness of CikguHub

As it stands, CikguHub is already useful as a prototype for the nonprofit! Experts have indicated that they want to introduce a select member of their interested parties to the prototype and get some preliminary feedback. Some premier researchers at the University of Michigan, Ann Arbor, have also indicated that this is a novel group for AI educational feedback.

8. Future work

Teacher development should not be a luxury, it is a necessity. Although CikguHub is only a Minimum Viable Product, it already provides immense value to Edvolution and some Malaysian teachers, helping them become better educators. There are many ways we can improve CikguHub. For example, we could improve the recommendation system by including shorter videos and future-forward questions to gain user retention. More work could be done to improve the report generation system by providing per-video feedback and explanation for each score. Moreover, we could include an explicit data privacy policy to gain users' trust. We could also brainstorm, design and implement an incentive-based system to encourage module completion.

9. Acknowledgments

Special thanks to all team members, Professor Anhong Guo, Chen Liang, all staff members in the CoE Honors community, and Edvolution for the invaluable help and guidance they provided to me throughout the capstone experience.

10. References

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