KMRA: AN INTERACTIVE EXPLORATION OF RESEARCH ARTICLE READING SUPPORT FOR VISUAL LEARNER

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INTRODUCTION & BACKGROUND

In an age of information overflow and brief online content, global reading proficiency is declining. Current students, from K12 to university, are struggling more with comprehension and engagement compared to earlier generations. Addressing this, the I propose KMRA, an intelligent reading tool in form of knowledge map, to assist novice visual learner. Using AI techniques, KMRA highlights key sections in research articles and presents them in a user-friendly knowledge map. Initial studies showed KMRA helped users locate information more efficiently than traditional methods. Feedback also indicated a desire for enhanced features, such as annotations. Overall, KMRA represents an innovative fusion of visualisation, active reading and research article, aimed at improving reading experience for novice visual leaner.

METHODOLOGY OF THE STUDY

I first identified the pain points of novice readers in actively reading research articles based on secondary research. Then, inspired by the "mismatch with visual learners' learning styles", I proposed the design concept of a visualisation-enabled KMRA (Knowledge Map Reading Assistant) reading assistant. Before starting the prototype, I reviewed 10 original research articles on reading assistants to understand the strengths and limitations of existing tools to promote active reading by novice readers; then I explored methods for combining Knowledge Map and Argument Zone(AZ) to promote active reading by novice readers, and determined the strategy of dividing the nodes of the knowledge mapping; and finally, I analysed the technical support required for KMRA and started to build the interactive prototype. To confirm the feasibility of the KMRA design concept, I recruited six participants to conduct tests focused on usability, user satisfaction tests and semi-structured interviews with the KMRA prototype.

PROBLEM DEFINED
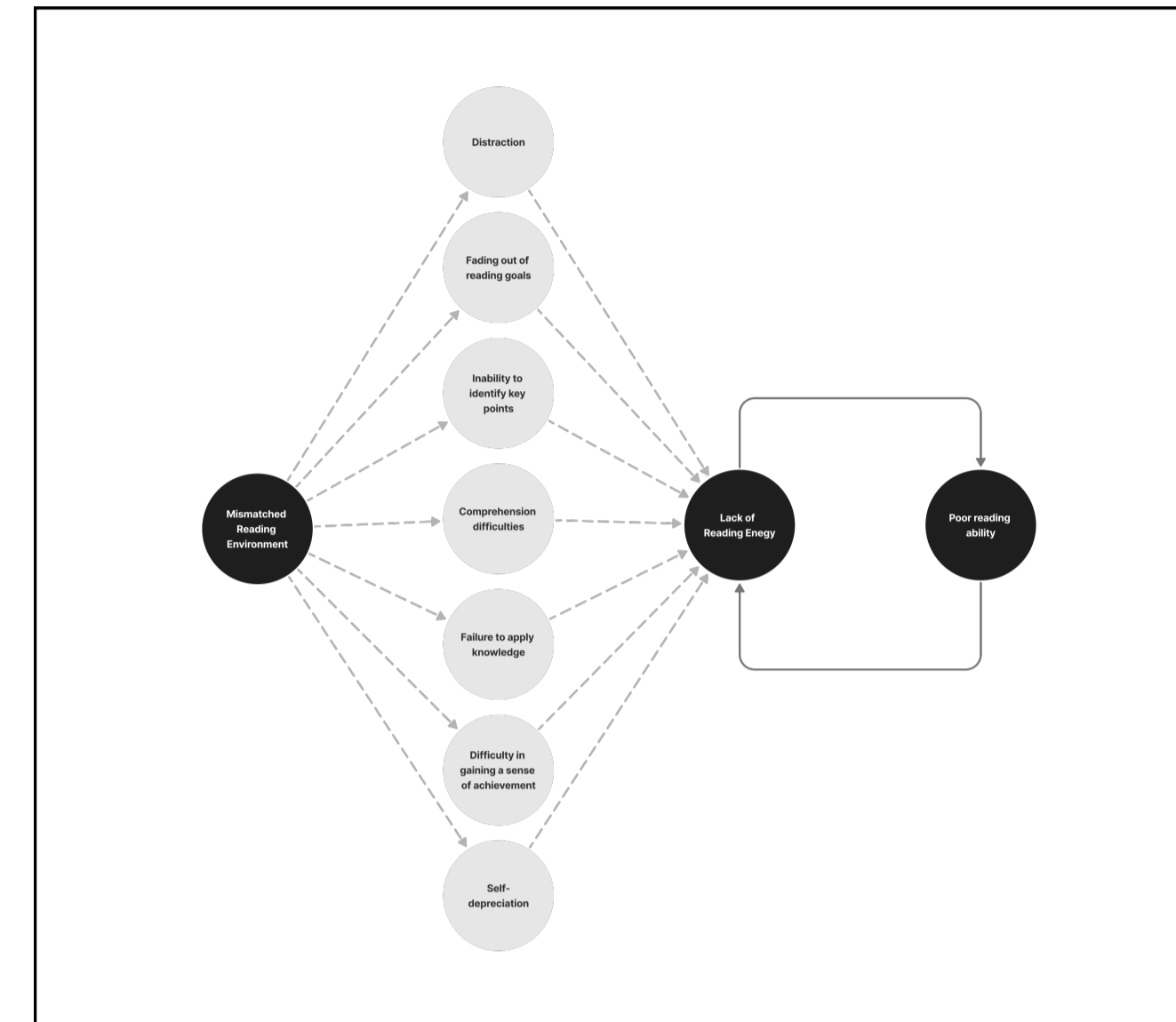
When reading text does not match learners' learning preferences, it can lead to resistance to reading. When learners are reluctant to read, they miss opportunities to improve their reading skills, which can further lead to a decline in reading ability. Unfortunately, this declining reading ability can further reduce their motivation to read. This is because when they try to read, they feel frustrated or unconfident because they have difficulty comprehending or connecting with the text. This experience may cause them to develop a deeper aversion to reading, leading to a greater tendency to avoid the activity. In this way, a vicious cycle is created between lack of motivation to read and low reading skills. In order to break this, there is a need for society to provide relevant visualisations and reading aids to ensure the availability of materials that match students' learning styles and promote active reading.
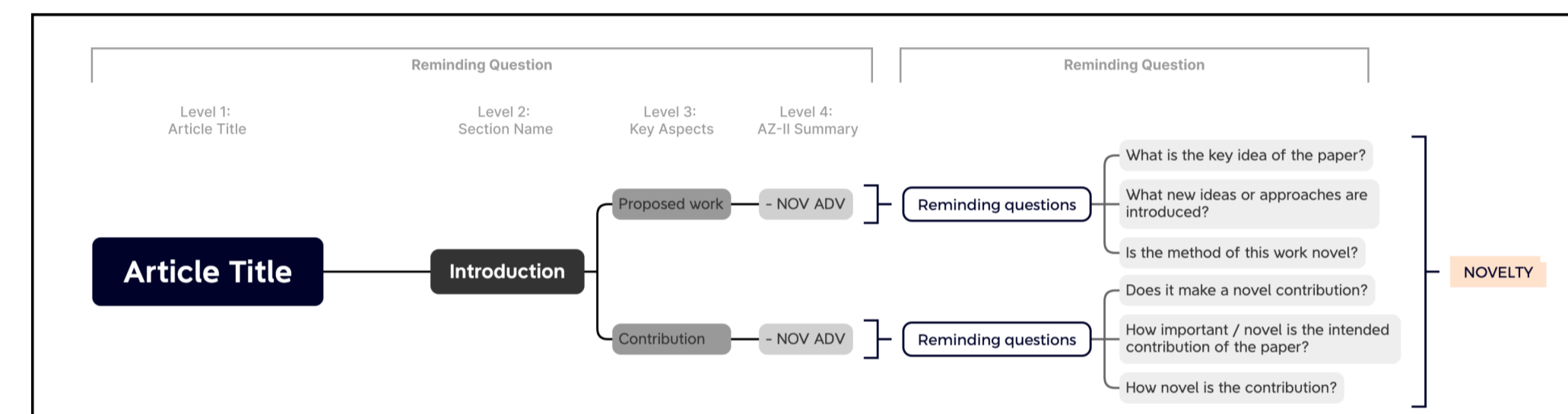
4 READING TARGETS
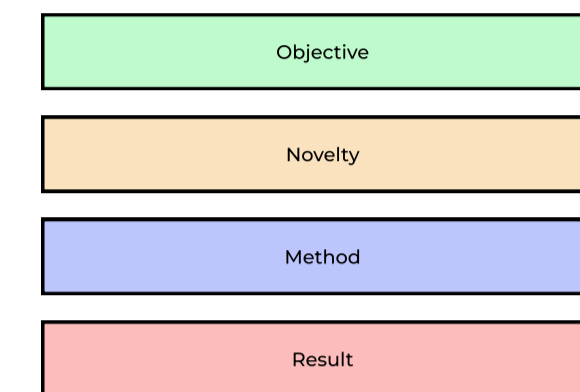
Base on user research, I found four key areas experts focus on in research articles.

DESIGN TARGET
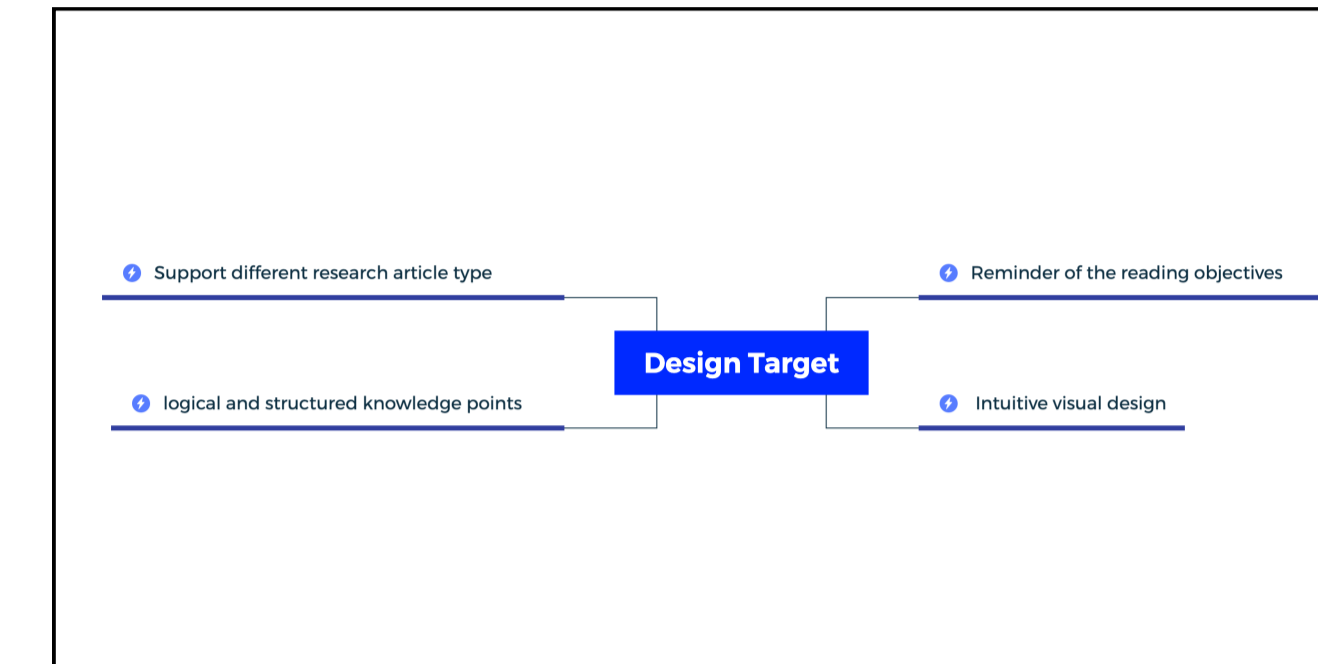
CONTENT ORGANISATION STRATEGY

To enhance the interpretability and specificity of AI-driven summaries, I proposed an automatic summarisation strategy for language models based on common reader objectives. Empirical research shows that experienced readers typically focus on four key sections of a research article: Objective, Novelty, Method, and Result. Providing a structured knowledge node distribution is essential to help novices grasp the key information in these articles. Without clear guidance and a structured content presentation, novice readers might lose sight of their reading objectives, becoming lost within the text.
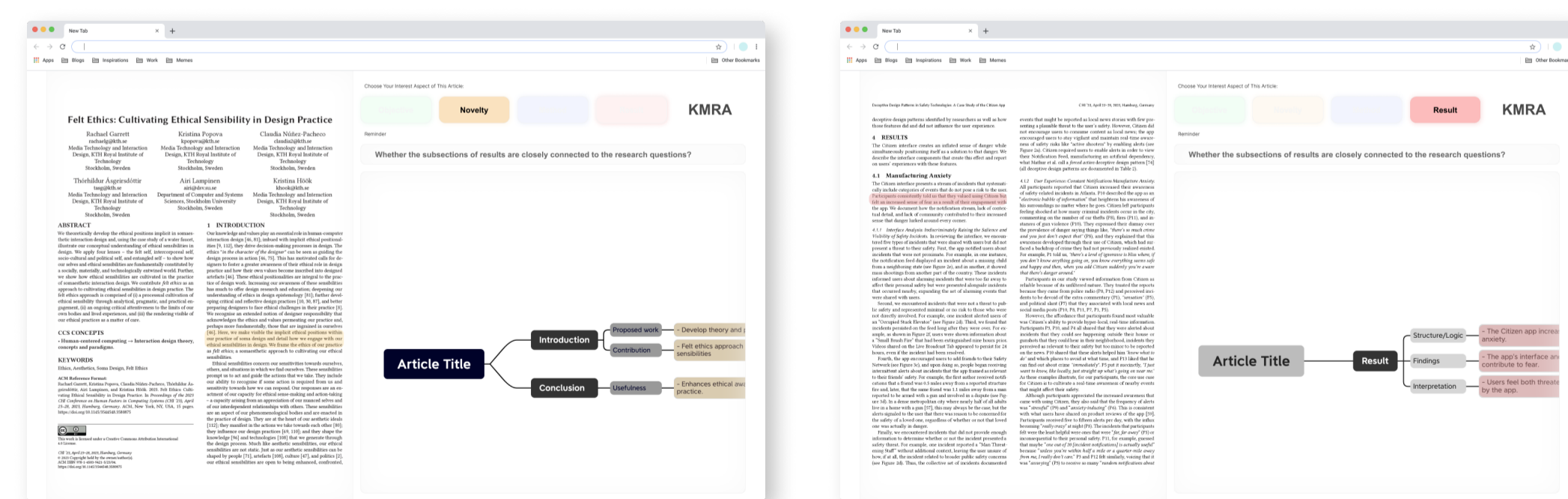
NODE OVERVIEW
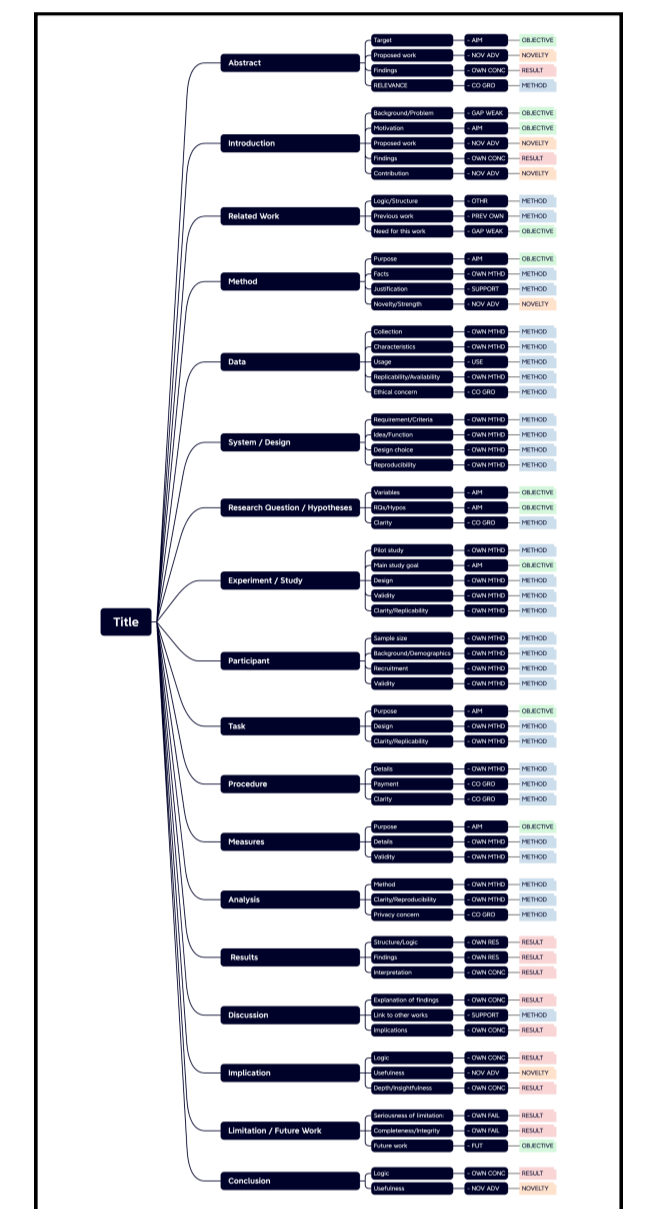
Front stage actions can be performed by employees or technology and assist the end-user actions.ogy and assist the end-user actions.

PROTOTYPE

The KMRA's prototype interface for summarising and organising research novelty and findings for testing is shown here.

KMRA highlights text by four reading target: research objectives, novel aspects of the study, methods, and results. In addition, KMRA meets the visualisation needs of novice readers by extracting answers through a language model and presenting them through a knowledge graph. Readers can access the original content in the original article by clicking on the sub-node links within the knowledge map.

TEST

TASK 1

Participants first fill out a questionnaire for testing their prior knowledge of the domain& reading strategy.

TASK 2

Participants read two texts via prototype or baseline, then answered comprehension questions.

TASK 3

Participants will be asked to complete the NASA-TLX Mission Load, SUS and QUIS questionnaires.

RESULT & EVALUATION

TASK 1&2 RESULT

In the first task, an ANOVA was conducted to assess participants' domain-specific a priori knowledge. The initial hypothesis was that there were no significant differences between the six participants. The results of the analysis showed that the differences were not significant ($F = 1.80$, $p > 0.05$), supporting the null hypothesis. The box plots also showed consistently lower levels of self-assessed proficiency, suggesting similar levels of novice proficiency. In addition, the ANOVA for reading strategy awareness also showed no significant difference ($F = 0.6$, $p > 0.05$), confirming the hypothesis of comparable knowledge. The temporal analyses showed no significant difference in reading time between the KMRA and baseline pairs of the two texts, which may be due to the small sample size. Cohen's d effect (Cohen's d) was moderate ($d = -0.31$) and large ($d = -1.5$) for text type, implying that the KMRA was superior in reading time. Although the length of Text 2 shows the potential of the KMRA in long text tasks, larger scale testing is still needed. In conclusion, the combined findings indicate consistent levels of proficiency and demonstrate the effectiveness of the KMRA in improving reading time, especially with long texts.

CONCLUSION & FUTURE WORK

In this study, I introduce a intelligent summary reading assistant design concept, KMRA, which leverages language modelling and visualisation techniques to aid novices in active reading of research articles. This tool transforms the content's hierarchical structure into a navigable reading aid. Through prior research, I identified challenges novices face in active reading. The KMRA offers a visual knowledge map interface, aiding deeper comprehension. Both quantitative and qualitative assessments showed KMRA reduces task load and enhances understanding.

My future goals include refining the KMRA for diverse genres and reading tasks. I aim to:

1. Further research to ensure that the KMRA has more significant benefits for promoting active reading
2. Stay updated with AI advancements to improve KMRA.
3. Incorporate reading strategies from experienced researchers for broader domain applicability.
4. Conduct broader studies to explore further benefits of KMRA.

While KMRA has been tested in the design domain, I will focus on enhancing scholarly reading experiences across disciplines, in less structured genres like art criticism or fiction.