Evaluating AI-Based Scaffolding for Learning Research Philosophies and Paradigms

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Abstract: Understanding research philosophies and paradigms (RPPs) is a fundamental component of research methodology education, yet many postgraduate students find these concepts abstract, difficult to distinguish, and challenging to apply when designing research studies. In addition, many postgraduate students struggle to identify the RPPs resonating with their worldview, making it difficult to align their ontological and epistemological assumptions with their research questions, methodological choices, and overall research design. Consequently, this challenge creates uncertainty in selecting appropriate research approaches, thereby limiting the coherence, consistency, and methodological rigor of their studies. The current study evaluated the effectiveness on an AI-based system designed to assist students in identifying and understanding appropriate RPPs congruent with their worldviews and research contexts. The study employs a quantitative one-group pre-test-post-test design, with participants completing a knowledge-base questionnaire before interacting with the system to establish their baseline understanding of RPPs. An equivalent post-test questionnaire to assess changes in knowledge was completed by the participants after using the system and reviewing the recommended RPPs and explanations. The Statistical Package for the Social Sciences (SPSS) was used to analyse and compare the test scores utilising descriptive and inferential statistical techniques. The findings showed an improvement in understanding of RPPs, demonstrating the potential of AI to provide personalized instructional support for complex methodological concepts while highlighting the importance of integrating AI as a supplement to lecturer-guided instruction. The study contributes to the growing body of research on artificial intelligence in higher education by providing empirical evidence on the use of AI to enhance students' understanding of research methodology. The findings have implications for educators seeking innovative approaches to teaching research philosophies and paradigms, and for the responsible integration of AI into postgraduate research training.

Keywords: Artificial Intelligence, Research Methodology, Research Philosophies, Research Paradigms, Higher Education, AI in Education

1. Background

Research philosophies and paradigms (RPPs) provide the foundational worldview that shapes every phase of the research process (Dulal, 2025). Philosophies are a set of beliefs and assumptions about what constitutes reality and how knowledge is generated, informing the research design, data collection and analysis, and the interpretation of the findings of a study (Saunders et al., 2019). According to Pretorius (2024), research paradigms refer to the broader framework of a combination of philosophical assumptions and methodological choices. Paradigms incorporate assumptions a researcher has about ontology (the nature of reality), axiology (the role of values in research), epistemology (how knowledge is created), and the methodology (instruments used to solve the research problem) guiding their research process (Pretorius, 2024; Saunders et al., 2023). To ensure logical consistency and transparency, Saunders et al. (2019) argue that researchers should clearly articulate their philosophical orientation and paradigmatic position at the beginning of the research process. To conduct research that is defensible, Makombe (2017) and Dulal (2025) assert that researchers need to consider their underlying philosophical assumptions when selecting methods, and that their philosophy must align with their research objectives.

Despite these assertions and the apparent importance of RPPs in the research process, Makombe (2017) observed that many researchers in their early careers fail to identify the research philosophy and paradigm that informs their investigation. Furthermore, literature reveals difficulties experienced by novice researchers in translating philosophical assumptions into appropriate methodological choices (Saunders et al., 2023; Pretorius, 2024). Creswell and Poth (2024) argue that these challenges are partly attributable to the persistent disconnect between theoretical discussions of RPPs and their practical application in research design. Scholars of research methodology further contend that the multiplicity of competing research paradigms, alongside continuing philosophical debates about their underlying assumptions and methodological implications, pose a significant challenge for novice researchers and postgraduate students (Guba & Lincoln, 1994; Johnson & Onwuegbuzie, 2004; Saunders et al., 2023). Casanave and Li (2023) found that a researcher's inability to develop and apply appropriate theoretical and conceptual frameworks to studies contributes significantly to a reduction in the overall credibility and quality of research. Gannon et al. (2022) assert that finding a suitable philosophical stance

necessitates a thorough understanding of the various philosophical stances as well as a critical awareness of one's own views and convictions about what reality and knowledge "are" and how new knowledge is found, developed, and/or validated. Nevertheless, novice researchers continue to experience difficulties with developing a clear and applied understanding of RPPs, particularly in relation to how these concepts inform methodological choices and research design

According to Nind and Lewthwaite (2016), these challenges indicate the need for instructional approaches that bridge the theory-practice gap in RPPs pedagogy. Lewthwaite and Nind (2018) advocate for a shift from traditional, content-focused approaches towards pedagogy wherein students participate in active research practices that will make the research course more accessible, explicit and meaningful. Similarly, Brew (2022) advocates for research pedagogy that engages students through inquiry-based learning and reflective practice instead of being passive recipients of knowledge. In recent years, the increasing adoption of artificial intelligence (AI), machine learning (ML), and natural language processing (NLP) has created new opportunities for enhancing personalised learning and research support in higher education. Despite these advances, literature has not revealed much evolution in research pedagogy, with traditional instruction still dominating how RPPs are introduced.

Zawacki-Richter et al. (2024) argue that the adoption of AI in institutions of higher learning should be informed or driven by educators to enable the shift from its application in administrative tasks to teaching, research and personalised learning. Similarly, Tlili et al. (2023) vouch for the integration of AI into research training for the enhancement of productivity and conceptual learning. To address the identified gap, this study developed and implemented an AI based software solution, the Research Philosophy Predictive Model (RPPM), that utilises a networked research philosophy predictive model to recommend a philosophical stance that aligns with a researcher's worldview and research context. This study investigates the potential of the RPPM to scaffold RPPs learning amongst postgraduate students. The study is guided by the following research question.

1.1 Research Question

RQ1: Does an AI-powered system have the potential to improve personalised learning and understanding of research philosophies and paradigms among postgraduate students?

1.2 Research Objective

RO1: To evaluate whether an AI-powered system has the potential to improve personalised learning and understanding of research philosophies and paradigms among postgraduate students.

This paper gives a brief overview of the Research Philosophy Predictive Model (RPPM) and the methodology employed to address the research question. Furthermore, the paper presents the findings of the evaluation conducted to determine the effectiveness of the system in enhancing postgraduate students' understanding of RPPs through a comparison of pre- and post-intervention knowledge. The following section discusses the Research Philosophy Predictive Model.

2. The Research Philosophy Predictive Model

The Research Philosophy Predictive Model (RPPM) is an adaptive software program that uses an online research philosophy predictive model to assist graduate students in selecting a philosophical position that best suit their individual characteristics, reducing the difficulties they encounter while conducting their research. The RPPM employs natural language processing methods, including Hashing and Term Frequency-Inverse Document Frequency (TF-IDF), in addition to the Classification and Regression Trees (CART) machine learning algorithm. The development of the RPPM application adhered to model building and Adaptive Software Development (ASD) approaches. To direct students toward the best course for their research, the RPPM uses predictive techniques to find connections and dependencies between personal characteristics, beliefs, and paradigms. The model not only makes research philosophical theories and concepts easier to understand, but it also aligns researchers' beliefs with different philosophical perspectives. The RPPM was designed to augment instructor-led instruction and delivery of the research methodology course. It includes interactive questionnaires that help participants to reflect on their inherent ontological, epistemological and axiological assumptions.

While the broader scope of this study included the development, implementation and deployment of the RPPM system for wider use in higher education settings, the objective of this paper is to present the findings obtained upon evaluating the system against the identified requirement (RQ1) and the research objective (RO1). As the

methodology for development, implementation and deployment of the RPPM system are beyond the scope of this paper, the following section presents the methodology applied in addressing the research question and objective.

3. Methodology

The overall study was conducted in four distinct phases: (1) the development of the RPPM system, (2) evaluation and selection of the ML algorithm for the predictive model, (3) evaluation of the usability of the system, and (4) evaluation of researchers' understanding of the RPPs and related terms before and after using the system. This paper reports only the findings of the fourth phase which evaluated the learning impact of the RPPM system.

3.1 Research Design

The study employs a quantitative one-group pre-test-post-test design, with participants completing a knowledgebase questionnaire before interacting with the system to establish their baseline understanding of RPPs. After using the system and reviewing the recommended RPPs and explanations, an equivalent post-test questionnaire was completed by the participants to assess changes in knowledge. A comparison of the responses from both questionnaires enabled the study to assess the effectiveness of the RPPM in scaffolding participants' understanding of the RPPs concepts.

3.2 Participants

The participants comprised postgraduate students enrolled in various faculties at multiple higher education institutions. Participation was voluntary, and informed consent was obtained from all participants. Of a total of 271 participants who completed the questionnaire, 167 of them were undergraduate students and were therefore not considered for the study analysis. A total of 104 of the participants were considered as valid participants, as they were all postgraduates. Table 1 shows the valid participants' levels and fields of study.

Table 1: Participants with levels and fields of study

Study Level	Frequency	Percent	Valid Percent	Cumulative Percent
DBA	12	11.54	11.54	11.54
DCom	1	0.96	0.96	12.50
MBA	2	1.92	1.92	14.42
MCom	4	3.85	3.85	18.27
MEng	4	3.85	3.85	22.12
MPhil	7	6.73	6.73	28.85
MSc	48	46.15	46.15	75.00
Other	8	7.69	7.69	82.69
PhD	18	17.31	17.31	100.00
Missing	0	0.00		
Total	104	100.00		

As shown, MSc students were in the majority (46.15%), followed by PhD students (17.31%), while MBA (1.92%) and DCom (0.96%) had the lowest percentages. Combining MBA, MCom, MEng and MSc indicated that most participants were at the Masters' level of study (63%). Similarly, combining DBA, PhD and DCom, showed that the participants at doctoral level came second (19.8%). Eight (8) participants (7.69%) stated their level of study as 'other'. The next section gives a brief overview of the RPPM system.

4. Data Collection

This paper reports only the findings of the pre- and post-questionnaires administered before and after participants' use of the RPPM system. The questionnaires were structured to measure their understanding of the RPPs concepts. Data collected for the curation of the dataset and usability of the system is outside the scope of this paper, only the data collected before and after participants' system use is discussed. Figure 1 below shows the process followed in obtaining the data used in this study.

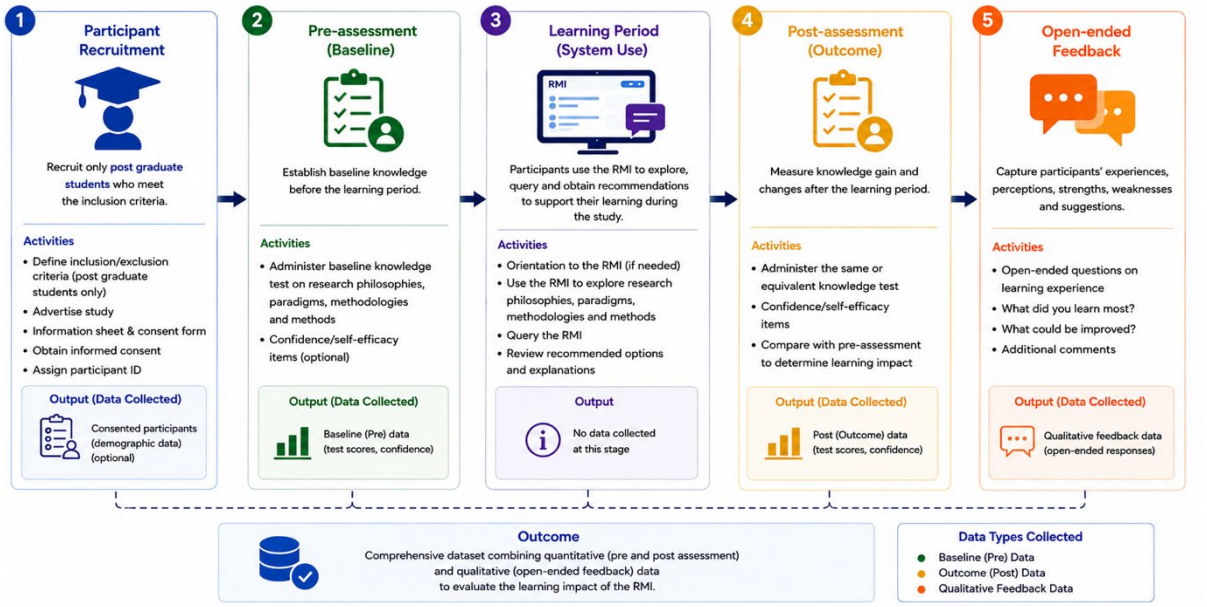


Figure 1: Data collection for learning impact evaluation.

4.1 Pre- and Post-Test Evaluation Procedure

To determine whether using the system significantly enhanced philosophy and paradigm knowledge, a one-tailed non-parametric pairwise dependent Wilcoxon signed-rank test was employed. The non-parametric Wilcoxon test offers a trustworthy mean difference test between two dependent observations for data that is not normally distributed (Dexter, 2013; Wiedermann & Von Eye, 2013). Table 2 shows the pre- and post-test evaluation questions as responded to by participants.

Table 2: Pre-test and post-test evaluation question

Pre-Evaluation Questions	Post-Evaluation Questions
E1: I know the meaning of research paradigms and philosophies.	O1: I know the meaning of research paradigms and philosophies.
E2: I understand the difference between research paradigms and philosophies.	O2: I understand the difference between research paradigms and philosophies.
E3: I have been taught of research paradigms and philosophies.	O3: I have been taught of research paradigms and philosophies.
E4: I find research paradigms and philosophies easy to understand.	O4: I find research paradigms and philosophies easy to understand.
E5: I understand the implications of my research paradigms and philosophies to knowledge development.	O5: I understand the implications of my research paradigms and philosophies to knowledge development.

Before interacting with the RPPM, participants completed a pre-test to assess the baseline knowledge and conceptual understanding of RPPs, prior exposure to the concepts, confidence in understanding them, and their role in knowledge development. Following completion of the pretest, participants engaged with the RPPM system and answered a series of questions which helped them reflect on their ontological, epistemological and axiological stances. The questionnaire comprised Likert-scale and open-ended questions. The system recommended three (3) RPPs with their degrees of association (Figure 2) based on the ML computations. Participants generated a report with the recommended RPPs, explanations and suggested sources, and were encouraged to examine and reflect on the recommendations prior to taking the post-test.

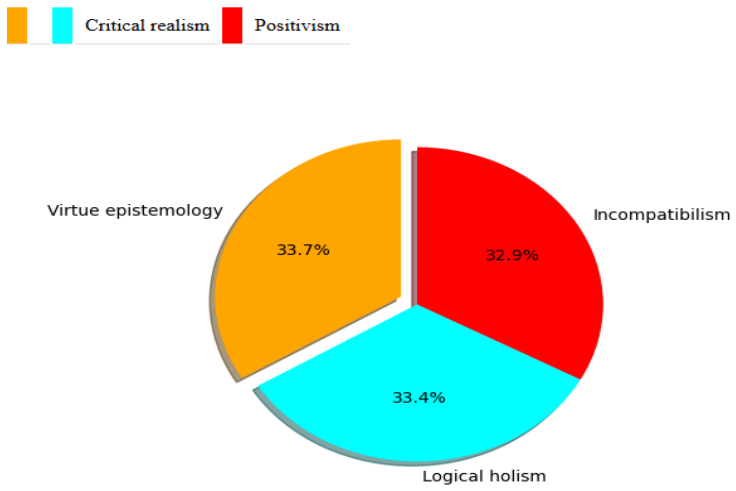


Figure 2: RPPs with their degrees of association

The participants completed the post-test after engaging with the system to assess whether using the RPPM has had any effect in their understanding of the methodological concepts. To determine whether participants demonstrated any measurable changes in their understanding of the RPPs concepts after engaging with the system, responses from both pre- and post-tests were compared. An analysis of the questions and answers obtained from the pre-evaluation and post-evaluation questionnaires was based on the Unified Theory of Acceptance and Use of Technology (UTAUT) model developed by Venkatesh et al. (2012). The interpretation of the findings was done using the Statistical Package for the Social Sciences (SSPS). The UTAUT model has been widely used to measure the usage and adoption of technology (Madigan *et al.*, 2017; Hoque & Sorwar, 2017).

The data obtained from the pre- and post-evaluation questionnaires was used to perform a Wilcoxon signed-rank test using SPSS. Table 3 below shows results of the paired sample test, with measure 1 representing the pre-evaluation data, and measure 2 representing the post-evaluation data for the alternative hypothesis that measure 2 is greater than measure 1.

Table 3: Paired sample test

					95% CI for Rank-Biserial Correlation	
Measure 1	**Measure 2**	**W**	**z**	**p**	**Lower**	**Upper**
E6	O1	104.000	-7.036	< .001	-∞	-0.892
E7	O2	229.500	-6.805	< .001	-∞	-0.802
E8	O3	120.000	-6.635	< .001	-∞	-0.857
E9	O4	216.000	-6.237	< .001	-∞	-0.762
E10	O5	343.000	-6.045	< .001	-∞	-0.686

According to the results presented in Table 3, there are statistically significant differences ($p < .001$) between the pre-evaluation and post-evaluation data for all items. The resulting z-values (-7.036, -6.805, -6.635, -6.237, -6.045) and their effect sizes (-0.892, -0.802, -0.857, -0.762, -0.686) indicate a large significant in differences between the paired means.

4.2 Instrument Validity

The study used an adapted UTAUT questionnaire, based on the validated instrument developed by Venkatesh et al. (2003), and a pre-test/post-test instrument that was reviewed by experts to establish content validity. Convergent and discriminant validity were confirmed using Pearson's correlation analysis ($p < 0.05$), with performance expectancy demonstrating a significant correlation ($r = 0.616$). The adapted UTAUT instrument demonstrated good reliability, with both Cronbach's alpha and McDonald's omega exceeding 0.70. The following section details the finding of the study.

5. Results

The RPPM combines natural language processing, machine learning and a curated dataset to automate the recommendation of a researcher's guiding philosophy and underlying paradigm based on their perception about the nature of reality (ontology), generation of knowledge (epistemology) and the impact values (axiology) have in conducting research. The novelty of the RPPM lies in that it reduces reliance on manual interpretation and offers a consistent, comprehensible, and evidence-based approach to study design by operationalising methodological expertise into an intelligent decision-support system. The study aimed at assessing the value of the RPPM in scaffolding understanding of research concepts amongst postgraduate students, the results are presented in the next sections.

5.1 Performance Expectancy

The participants' responses to questions were noted to investigate the level of performance improvement obtained from using the system. The questions were related to how the system improved researchers' understanding of the RPPs and related terms. The questions together with the results are displayed in Table 4.

Table 4: Performance expectancy

Expectancy	Scores - frequency (percentage)				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
PE1: Using the system in my research enables me to accomplish research tasks more quickly.	5 (4.81)	15 (14.42)	36 (34.62)	35 (33.65)	13 (12.5)
PE2: Using the system improves my epistemological understanding.	3 (2.89)	11 (10.58)	30 (28.85)	42 (40.39)	18 (17.31)
PE3: Using the system in my research increases my application of paradigm and philosophies.	0 (0)	10 (9.62)	24 (23.08)	45 (43.27)	25 (24.04)
PE4: Using the system makes it easier to do research.	5 (4.81)	5 (4.81)	40 (38.46)	41 (39.42)	13 (12.5)
PE5: Using the system enables me to understand the implications of my paradigm and philosophies to knowledge development.	2 (1.92)	10 (9.62)	25 (24.04)	42 (40.39)	25 (24.04)
PE6: I find the system useful in my research.	4 (3.85)	11 (10.58)	30 (28.85)	39 (37.5)	20 (19.23)
PE7: Use of the system will have no effect on my research.	28 (26.92)	39 (37.5)	21 (20.19)	13 (12.5)	3 (2.89)
PE8: Use of the system can decrease the time needed for my research.	11 (10.58)	13 (12.5)	32 (30.77)	40 (38.46)	8 (7.69)
PE9: Use of the system can significantly increase the quality of my research output.	5 (4.81)	10 (9.62)	30 (28.85)	50 (48.08)	9 (8.65)
PE10: Use of the system can increase the effectiveness of performing research tasks.	4 (3.85)	11 (10.58)	26 (25)	46 (44.23)	17 (16.35)
PE11: Use of the system can increase the quantity output for the same amount of effort.	7 (6.73)	14 (13.46)	35 (33.65)	34 (32.69)	14 (13.46)
PE12: Using the system improves the quality of my research.	5 (4.81)	7 (6.73)	36 (34.62)	42 (40.39)	14 (13.46)
PE13: Using the system makes it easier to apply paradigms and philosophical stance.	1 (0.96)	8 (7.69)	27 (25.96)	43 (41.35)	25 (24.04)
PE14: Using the system enhances my effectiveness with respect to the epistemological concepts.	2 (1.92)	12 (11.54)	24 (23.08)	52 (50)	14 (13.46)
PE15: The system reduces the time spent on philosophical and paradigm issues and increases my research productivity.	4 (3.85)	8 (7.69)	30 (28.85)	49 (47.12)	13 (12.5)
PE16: I now know the meaning of research paradigm and philosophies.	1 (0.96)	14 (13.46)	26 (25)	38 (36.54)	25 (24.04)

Expectancy	Scores - frequency (percentage)				
	Strongly disagree	**Disagree**	**Neutral**	**Agree**	**Strongly agree**
PE17: I now understand the difference between research paradigms and philosophies.	3 (2.89)	17 (16.35)	26 (25)	40 (38.46)	17 (16.35)
PE18: I have been taught of research paradigms and philosophies.	2 (1.92)	11 (10.57)	29 (27.89)	37 (35.58)	25 (24.04)
PE19: I now find research paradigms and philosophies easier to understand.	3 (2.89)	17 (16.35)	47 (45.19)	27 (25.96)	10 (9.62)
PE20: I now understand the implications of my research paradigms and philosophies to knowledge development.	3 (2.89)	9 (8.65)	31 (29.80)	42 (40.39)	19 (18.27)

According to the results presented in Table 4, a minority of the participants (19.23%) strongly disagreed or disagreed that using the system enabled them to accomplish research tasks more quickly, while a little less than half (46.15%) agreed or strongly agreed with this statement. The results also indicate that the majority of the participants agreed or strongly agreed to the system improving their epistemological understanding (57.7%) and increasing their application of paradigms and philosophies (67.31%).

It was also noted from the results that the majority of the participants agreed or strongly agreed to the system making it easier to do research (51.92%). Additionally, the majority of the participants also agreed or strongly agreed to the system enabling them to understand the implications of their paradigm and philosophies to knowledge development (64.43%), as well as finding the system useful in their research (56.73%).

The results also indicated that most of the users (64.42%) were not in agreement that use of the system will have no effect on their research. It was also noted that slightly less than half of the participants (46.15%) found that use of the system can decrease the time needed for their research and increase the quantity output for the same amount of effort. More than half of the participants indicated that use of the system significantly increases the quality of their research output (56.73%), increases the effectiveness of performing research tasks (60.58%) and improves the quality of their research (53.85%). Slightly less than half of the participants expressed that use of the system can increase the quantity output for the same amount of effort.

It was further noted that many of the participants noted that using the system makes it easier to apply their paradigms and philosophical stance (65.39%), enhances effectiveness with respect to the epistemological concepts (63.46%), and reduces the time spent on philosophical and paradigm issues. In the same vein, more than half of the participants indicated that using the system increases their research productivity (59.62%).

The results also indicated that most of the participants (60.58%) knew the meaning of research paradigm and philosophies after using the system. More than half of the participants (54.81%) also understood the difference between research paradigms and philosophies at that point. The majority of the participants (59.62%) also felt that they have been taught of research paradigms and philosophies. As related to whether participants found research paradigms and philosophies easier to understand after using the system, there were more in agreement (35.58%) than in disagreement (19.24%). The majority (58.66%) of the participants understood the implications of their RPPs in terms of knowledge development.

The results showed that, from a teaching perspective, the system encouraged students to stop and think about their ontological, epistemological, and axiological perspectives. It also gave them a way to label these perspectives. As a result, this reflection and labeling can be done at the start of the students' research project, giving them a roadmap and direction for their studies. This finding would add to and support earlier research by Sefotho (2015) and Brown and Dueñas (2019), who contend that research philosophy and worldviews should be decided upon at the outset of research studies.

From a learning standpoint, the results showed that most of the post-graduate participants discovered helpful information that enhanced their comprehension of philosophical terms. The majority of these participants (67.31%) thought the system helped them better grasp epistemological concepts, increase their productivity, and improve the calibre and efficacy of their research. Furthermore, most participants (60.58%) said that the system enhanced their understanding of research paradigms and philosophies and made it simpler to apply them to the advancement of knowledge. These findings suggest that after utilising the system, the participants understood the significance of research paradigms and philosophes. Since students had been taught about research paradigms and philosophies, they were also aware of the distinction between the two.

The interpretation is that the system has great potential to alleviate a researcher's dilemma in gaining an understanding of the fundamental concepts related to philosophy. As explained by Sefotho (2015), most novice researchers face challenges in understanding the differences between philosophy and paradigm.

The study further affirmed that use of the system also expanded their knowledge of paradigm and philosophies in research. The implication of this is that the system can be recommended for use by research students to broaden their knowledge regarding philosophy and its system in research. The outcome is a great contribution to reducing the daunting and time-consuming task of paradigm and philosophy selection, according to studies by Brown and Dueñas (2019).

Similarly, the current study found that knowledge obtained from the system assisted participants in understanding the implications of personal paradigm and philosophical stance to knowledge creation. This finding is in line with Casanave and Li's (2015) recommendation that novice researchers need to gain a deeper understanding of the of the RPPs concepts through selecting frameworks that fit their research, extensive reading about the frameworks and seeking guidance from experts. In the same vein, students indicated that using the system enhanced effectiveness with respect to the epistemological concepts, thus increasing their research productivity. It was further revealed that the quality of research output and the effectiveness of performing research tasks would be improved significantly through knowledge obtained from the system. This concurs with previous studies by Tan (2013) and Wong et al. (2015), which confirmed the significance of perceived performance improvement to technology acceptance in mobile learning. Similar confirmation was shown for mobile banking in a study by Yu (2012).

6. Conclusion

This study concludes that AI, particularly the RPPM system, has the potential to alleviate the difficulties experienced by novice researchers in developing theoretical and conceptual frameworks. By challenging researchers to reflect on their inherent ontological, epistemological and axiological assumptions, and recommending RPPs in line with their expressed views, the RPPM offers structured guidance to theoretical knowledge, and engagement with the concepts. These findings are consistent with the work of Class (2024), Lewthwaite and Nind (2016) and Tlili et al. (2023), who advocate for technologically enhanced and pedagogically informed approaches to research methodology education. Furthermore, the findings reinforce those of Dede (2014), Wu (2023) and Yan et al. (2024) that support the use of AI to enhance learning through the provision of personalised support, timeous feedback with the prospect of deeper and meaningful learning experiences within the humanities and social sciences disciplines. This study contributes empirical evidence that AI has the potential to effectively complement traditional research methodology instruction when combined with established pedagogical principles.

Ethics Declaration

Ethical clearance to conduct the study was granted by the the University of South Africa (UNISA) (Ethics clearance reference no. 2016_CRERC_009(FA)) and informed consent was obtained from the participants.

AI Declaration

To assist in brainstorming ideas, improvement of sentence structures, finding sources and to assist in creating illustrative figures included in this this paper, ChatGPT (OpenAI), Grammarly and Quillbot were used. The final writing has been reviewed by the authors, ensuring the information contained herein is accurate. This paper is compiled in line with the University of South Africa's (UNISA) academic integrity requirements. The authors bear full responsibility for the work submitted to the 3rd International Conference on Education Research (ICER 2026).

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