

Digital Competence and Professional Development on Action Research Capability of Basic Education Teachers

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Abstract. This study examined the influence of digital competence and professional development on the action research capability of basic education teachers in Maramag 1 District, Bukidnon. Using descriptive statistics and correlation coefficients, the research identified predictor variables affecting teachers' action research capabilities. Teachers demonstrated a high level of digital competence across various domains, including technological operations, social and ethical, pedagogical, and professional. They also demonstrated high levels of professional development through training and seminars attended, as well as self-efficacy and advanced degrees. However, their action research capabilities were rated as moderately capable, particularly in areas such as topic selection and data analysis. The study found significant relationships between digital competence, professional development, and action research capability. This indicates that increasing digital competence and professional development significantly enhances teachers' action research capabilities, leading to the rejection of the null hypothesis, which states that there is no relationship between digital competence and professional development on the action research capability of basic education teachers.

Keywords: Action research; Advanced degrees; Basic education teachers; Digital competence; Professional development.

1.0 Introduction

Educational institutions worldwide are undoubtedly exerting efforts to provide world-class, inclusive, and quality education for all. In the pursuit of quality education, the education sector continuously develops, implements, and evaluates academic instruction, as well as develops policies and programs (Tolentino, 2021). These reforms and modifications are evidence-based, aligning with results-oriented studies and research. Hence, action research in the educational system has become one of its pivotal functions, improving the status of education, particularly in teaching and learning processes, and serves as a benchmark to assess the achievement of its vision, mission, goals, and objectives.

Action research is recognized worldwide for its ability to empower educators, provide practical solutions to real problems, foster collaboration, and contribute to evidence-based educational practices. Action research can lead to meaningful changes in teaching and learning environments (Kemmis & McTaggart, 2000). The basic education teachers in the Department of Education (DepEd) are encouraged to conduct action research to address issues and concerns in the classroom or school for continued improvement. This support includes funding and resources for teachers to conduct their studies, as encouraged by the Basic Education Research Agenda (DepEd, 2021).

Despite the recognized benefits of action research, many educators face challenges that hinder their ability to conduct thorough investigations into their teaching methods. Recent studies indicate that while teachers exhibit a moderate level of competence in action research, variances exist based on factors such as educational attainment and years of experience (Amenabar & Pontillas, 2024). Even with the mandate, records indicated that few teachers in the Maramag 1 District in the Division of Bukidnon had submitted action research and were approved by the Schools Division Superintendent. Abarro and Mariño (2016) revealed that public secondary and elementary school teachers had an average level of research capabilities in writing the different parts of a research proposal and a publishable research paper or article, and a low level in using the American Psychological Association (APA) bibliography format. A particular study also found that conducting action research is highly challenging for secondary teachers due to financial constraints, time limitations, and the procedures of the Division Office (Abrenica & Cascolan, 2022).

While several existing studies have established the significance of action research in our educational system and have identified the general challenges faced by teachers in writing action research, certain gaps still exist in addressing the specific needs of basic education teachers. Recent literature has not adequately explored the development of generic and efficient professional development programs to enhance the action research capabilities of basic education teachers. Most research on digital competence and professional development focuses on higher education or general teacher training. There is a gap in studies specifically targeting basic education teachers and their unique challenges in conducting action research (Borreo, 2023). Thus, this ignited the researcher to assess the research capability of basic education teachers in the District of Maramag 1, Schools Division of Bukidnon, to provide school administrators and policymakers with a perspective as to how they plan for efficient program and activities that will help basic education teachers enhance their action research capability and to examine further the issues and challenges of the respondents in conducting and making action research in terms of digital competence and professional development. Indeed, action research serves as a tool for understanding society's needs, and commitment to research benefits teachers in nurturing constant growth and Development (Manalili, 2016).

The action research capability of basic education teachers was assessed in this study to determine their knowledge and skills in conducting action research and to examine how it is influenced by digital competence and professional Development. Digital competence refers to the ability to effectively and responsibly utilize digital technologies, tools, and resources to access, evaluate, create, and responsibly disseminate information. Digital competence is crucial for enhancing teachers' research capabilities by enabling them to utilize digital tools and resources effectively. With access to online databases, teachers can conduct thorough literature reviews and gain a variety of knowledge by utilizing internet databases, scholarly publications, and research papers (Cahapay & Anoba, 2021). Digital competence significantly enhances the research capability of teachers by providing them with the necessary tools and skills to conduct effective research. Proficiency in technology allows educators to access a broader range of resources, collaborate with peers, and disseminate their findings more efficiently (Saad & Sankaran, 2020). This capability is particularly crucial in the current educational landscape, where digital competence is essential for both teaching and research activities.

On the other hand, professional development involves gaining new skills through continuing education and career training after entering the workforce. It can include taking classes or workshops, attending professional or industry conferences, or earning a certificate to expand your knowledge in your chosen field (Harvard Division of Continuing Education, n.d.). According to Chu et al. (2017), teachers' Professional Development helps them meet new expectations to facilitate the Development of 21st-century skills in student-centered learning.

Basic education teachers should possess research skills to produce excellent, relevant, and responsive research outputs that contribute meaningfully to the current state of education in the country. Furthermore, as teachers engage in action research, they cultivate critical thinking skills and a reflective mindset that benefit both their professional Development and the overall educational experience of their students. This reflective practice not only promotes professional Development but also fosters a collaborative culture among teachers, encouraging them to share insights and strategies that can lead to improved instructional methods (Corpuz, 2023). As teachers become more adept at conducting action research, they contribute to a more dynamic learning environment where student engagement and achievement can flourish (Salahuddin & Khatun, 2022). This study was conducted to

examine the influence of digital competence and professional development on the action research capability of basic education teachers in Maramag 1 District, Bukidnon, during the 2024-2025 school year.

2.0 Methodology

2.1 Research Design

The study employed a descriptive–correlational research design to investigate the relationship between the dependent and independent variables. A descriptive correlational design is a research study in which the researcher seeks to describe a relationship among variables without attempting to infer a causal relationship (Devi et al., 2022). It is descriptive because it sought to describe the level of digital competence and professional development in action research capability among basic education teachers in Maramag 1 District. It is correlational because it sought to determine the relationship between the independent and dependent variables of the study. The researcher gathered data using a validated research instrument. The independent variables were professional development and digital competence; the dependent variable was the action research capability of primary and secondary education teachers.

2.2 Research Respondents

The respondents in this study were 310 basic education teachers, specifically the permanent public-school elementary and secondary teachers of the Maramag 1 District, Division of Bukidnon, for the school year 2024-2025.

2.3 Research Instruments

Three questionnaires were used in this study. The first instrument was a standardized questionnaire adapted from the National ICT Competency Standards for Teachers (NICS), which is composed of 76 statements and five levels of competence. This tool is available online and can be downloaded in PDF format. The higher the score, the higher the level of teachers' ICT skills; lower scores indicate a lower level of ICT skills among teachers. The tool is used to provide performance indicators for evaluating the level of knowledge and competence of teachers in applying ICT in the educational setting. The questionnaire is divided into four (4) domains, which are technology operations and concept, social and ethical, pedagogical, and professional. The scale is ideal for the study, as it was found to have excellent content validity, and educators widely use it to assess the ICT skills of teachers worldwide.

The second instrument in this study was a 17-item survey questionnaire designed for professional development among teachers. The questionnaire was categorized into training and seminars attended, self-efficacy, and advanced degree, based on the study by Longkiao-Canubas (2019), with a Cronbach's Alpha of 0.90. The third questionnaire was a self-report scale called TCAR, developed by Cortes et al. (2020), based on the constructs of Johnson's (2008) Model of AR, with a Cronbach's alpha of 0.989. This 54-item scale was developed to assess the componential needs and the componential Development of teachers before and after a professional development program on designing AR projects. The 54 items are distributed unevenly in seven factors, namely: analyzing and presenting AR data (13 items), reflecting on and communicating results (13 items), planning an AR project (11 items), integrating ethics (8 items), selecting a topic for professional growth (4 items), incorporating technology in writing literature (2 items) and integrating technology in analyzing data (3 items). The scale obtained a Cronbach's alpha coefficient of 0.989, indicating high reliability. The teachers' responses were collected using a 5-point Likert scale, where 5 represents the highest level of competence and 1 represents the lowest level of competence.

2.4 Data Gathering Procedure

An endorsement letter was secured from the Dean of the College of Education at Central Mindanao University, requesting permission to conduct the study. The researcher prepared a letter of request addressed to the Superintendent of Schools. The researcher personally visited the different schools in the specified district, following a scheduled visit and obtaining permission from the school principals. Right after the approval, the researcher distributed the research questionnaire to all schools included in the study. The questionnaires were then retrieved from the respondents, and the data gathered were coded and analyzed using SPSS (Statistical Package for the Social Sciences) software.

2.5 Data Analysis Procedure

Responses to the questionnaires and other pertinent data were collected, summarized, translated, and analyzed. Descriptive statistics were employed for the summary and analysis of data. The relationship between the independent and dependent variables was analyzed using the correlational coefficient.

Multiple regression was employed to determine the predictor variables that influence the action research capability of basic education teachers. Multiple regression analysis is a crucial tool for understanding the simultaneous impact of multiple factors on a specific outcome. Unlike simple regression, which investigates the influence of a single independent variable, multiple regression allows researchers to predict the value of a dependent variable using two or more independent variables (Scribbr, 2023).

2.6 Ethical Considerations

The researcher has provided each respondent with a consent form to explain the study's objectives and procedures clearly, and has addressed any questions or concerns the respondents may have regarding their participation in the study. The respondents' participation was protected by the following measures: The researcher took all necessary precautions to ensure the privacy and confidentiality of the responses and any personal information, and the primary identification was not recorded, thereby ensuring respondents' anonymity.

3.0 Results and Discussion

3.1. Teachers' Level of Digital Competence

Table 1. *Summary of Teachers' Level of Digital Competence*

Sub-variables	Overall Mean	Descriptive Rating	Qualitative Interpretation
Technological Operations and Concepts Domain	2.98	Experienced	Competent
Social and Ethical Domain	2.97	Experienced	Competent
Pedagogical Domain	2.90	Experienced	Competent
Professional Domain	2.82	Experienced	Competent
Overall Mean	2.94	Experienced	Competent
Level Of Digital Competence			

The four domains or subcategories of digital competence, namely technological operations and concepts, social and ethical, pedagogical, and professional, with the means of 2.98, 2.97, 2.90, and 2.82, respectively, have the same qualitative description: experience. The overall mean for the level of digital competence is 2.94, which indicates that while teachers in the Maramag 1 District demonstrate proficiency across all domains, they would benefit from targeted training to achieve a higher level of mastery, particularly in the Professional Domain. Numerous studies support this finding, such as one that shows educators' self-reporting of technology use and their actual practice of usage at work are separate. This aligns with the other findings that further training is needed to improve proficiency, particularly in the Professional Domain (Yang et al., 2021).

The qualitative summary of "Experienced" with working across the domains of digital competence shows a middle ground among the teachers in the Maramag 1 District. However, it also points out that there is a considerable need for more Professional domain-focused training and programs structured to aid the attainment of skills mastery. Refined action research programs that incorporate digital tools into professional development can enhance the digital competence of teachers in elementary and secondary education. School administrators should conduct training focused on software for data collection, analysis, and literature reviews, as well as report writing and management. Basic education teachers are encouraged to actively utilize advanced digital tools to transform the action research process. Efficient research processes, facilitated by sophisticated data collection, analysis, and presentation tools, will optimize research productivity.

3.2. Teachers' Level of Professional Development

Table 2. *Summary of Teachers' Level of Professional Development*

Sub-variables	Overall Mean	Descriptive Rating	Qualitative Interpretation
Advanced Degree	3.78	Agree	Highly Developed
Training and Seminars Attended	3.77	Agree	Highly Developed
Self-Efficacy	3.76	Agree	Highly Developed
Overall Mean	3.77	Agree	Highly Developed
Professional Development			

The three domains or subcategories of professional development of teachers have an overall mean of 3.77, namely: training and seminars attended, self-efficacy, and an advanced degree, with means of 3.77, 3.76, and 3.78, respectively. It can be inferred that all subcategories have the same qualitative interpretation of 'Highly

Developed'. The findings imply that the teachers of Maramag 1 District exhibited a highly developed level of professional Development in terms of training and seminars attended, self-efficacy, and advanced degrees. Darling-Hammond (2000) emphasizes how further education enhances a teacher's skills and knowledge, leading to improved instructional practices and higher student achievement. Teachers' self-efficacy impacts their professional Development, as captured in Bandura's (1997) work, which asserts that teachers who perceive themselves as competent tend to seek and benefit from professional development programs actively. This is consistent with the self-efficacy levels of the teachers in Maramag 1 District, which supports their professional growth. In this manner, it can be said that teachers in Maramag 1 District have higher professional Development, as shown by their participation in training and seminars, their levels of self-efficacy, and their possession of graduate degrees. These enable them to be effective educators. Although the basic education teachers of Maramag 1 District demonstrated a high level of professional Development, it is fundamental to design more focused and specialized action research training programs for them. School administrators may plan practical workshops that focus on topics such as topic selection, project planning, data analysis, and other relevant strategies to enhance teachers' competencies.

3.3. Teachers' Level of Action Research Capability

Table 3. *Summary of Teachers' Level of Action Research Capability*

Sub-variables	Overall Mean	Descriptive Rating	Qualitative Interpretation
Integrating Ethics in Action Research	3.52	Moderately Capable	Moderate Competence
Integrating Technology in Writing Literature	3.48	Moderately Capable	Moderate Competence
Selecting a Topic for Professional Growth	3.44	Moderately Capable	Moderate Competence
Planning an Action Research Project	3.42	Capable	High Competence
Reflecting on and Communicating Results	3.28	Moderately Capable	Moderate Competence
Analyzing and Presenting Action Research Data	3.13	Moderately Capable	Moderate Competence
Integrating Technology in Analyzing Data	3.03	Moderately Capable	Moderate Competence
Overall Mean	3.32	Moderately Capable	Moderate Competence
Level Of Action Research Capability			

It can be gleaned that the action research capability of basic education teachers obtained an overall mean of 3.32. The teachers rated all the sub-variables as moderately capable. The highest-rated sub-variables are "Integrating Ethics in Action Research" (3.52) and "Integrating Technology in Writing Literature" (3.38). The least-rated sub-variables are "Analyzing and Presenting Action Research Data" (3.13) and "Integrating Technology in Analyzing Data" (3.03). This finding suggests that the teachers in Maramag 1 District have a moderate level of competence in conducting action research. This finding is consistent with the results of action research conducted by Kuo (2015), which aimed to improve the effectiveness of technology integration in preservice teacher education. Kuo argues for the need for frameworks like TPACK to enhance teachers' ability to incorporate technology into various educational tasks.

Similar to Dublar (2023), this study also compared the impact of emerging technologies on knowledge and skill acquisition in the Philippine education system, recommending a targeted training program that utilizes technology and data analysis to address skill gaps. Additionally, a systematic review of the literature on ICT integration in teaching and learning (Mohd et al., 2024) found that Challenges in using ICT in classrooms, such as limited skills and a lack of resources, are consistent with the study findings regarding teachers' difficulties in investigating and reporting research findings. As a result, school administrators are encouraged to actively involve teachers in action research projects to address specific challenges in their classrooms or communities. Offering time, resources, and institutional support for such projects can help teachers apply their skills in real-world situations.

3.4. Correlation on Digital Competence, Professional Development Towards Action Research Capability of Basic Education Teachers

The table reveals that all nine (9) variables are statistically significant to the action research capability of basic education teachers. It can be inferred that all correlations have a p-value of 0.000, indicating they are statistically significant at a high level. Digital Competence exhibits a positive correlation with the action research capability of basic education teachers ($r = 0.640$), indicating that as Digital Competence increases, the action research capability of these teachers tends to increase significantly. Similarly, Technological Operations and Concepts have a moderate positive correlation ($r = 0.568$), indicating that higher values in Technological Operations and Concepts are associated with higher levels of action research capability of basic education teachers. The correlation between

Social and ethical is also strong ($r = 0.610$), reinforcing the notion that increases in Social and Ethical correspond with increases in the action research capability of basic education teachers.

Table 4. Analysis of Independent Variables and Action Research Capability of Basic Education Teachers

Variable	r-value	Probability
Digital Competence	.640**	.000
Technological Operations and Concepts	.568**	.000
Social and Ethical	.610**	.000
Pedagogical	.570**	.000
Professional	.567**	.000
Professional Development	.601**	.000
Training and Seminars Attended	.544**	.000
Self-Efficacy	.584**	.000
Advanced Degree	.513**	.000

** Correlation is significant at the 0.01 level (2-tailed).

b. Listwise N=310

In terms of other variables, Pedagogical ($r = 0.570$) and Professional ($r = 0.567$) both exhibit moderate positive correlations, suggesting that higher levels of these variables are associated with a higher action research capability among basic education teachers. Professional Development also shows a strong positive correlation ($r = 0.601$), indicating that improvements in this area are associated with higher action research capability of basic education teachers. Trainings-Seminars Attended ($r = 0.544$) and Self-Efficacy ($r = 0.584$) reveal moderate to strong correlations, indicating a positive relationship with the action research capability of basic education teachers. Lastly, while an Advanced Degree has the weakest correlation among the variables ($r = 0.513$), it still indicates a moderate positive association with the action research capability of basic education teachers. Therefore, a significant relationship exists between digital competence, professional development, and the action research capability of basic education teachers, displaying a range of correlations from moderate to strong. The significance of these correlations suggests that these relationships are reliable and not due to chance. Hence, the null hypothesis that there is no relationship is hereby rejected.

Overall, the findings suggest that enhancements in these areas are associated with improved action research capabilities among basic education teachers. Specifically, as teachers improve their digital skills and engage in professional development, their ability to conduct action research is also enhanced. This view is also supported by Fernández-Miravete and Prendes-Espinosa (2022), who note that improving teachers' digital skills is needed to cope with the challenges of a digital society (in particular, through professional Development and the adoption of new teaching methods). Furthermore, the recent identification of comprehensive scales to assess the digital competencies of teachers, as reported in a study published in *Frontiers in Psychology*, underscores the need to measure these skills in order to inform teacher training programs and thus improve educational outcomes (Rodríguez-García et al., 2024). Since this study shows a good relationship between digital competence, professional Development, and the action research capability of basic education teachers, teachers are encouraged to conduct action research.

3.5 Variables Best Predict Action Research Capability of Basic Education Teachers

Table 5. Regression Analysis of Action Research Capability of Basic Education Teachers

Independent Variables	Coefficients		Beta	T	Sig.
	Unstandardized Coefficients	Std. Error			
(Constant)	.232	.183		1.268	.206
SE_PD	.205	.062	.205	3.316	.001
AD_PD	.144	.048	.168	2.981	.003
SE_DC	.238	.085	.197	2.788	.006
P_DC	.190	.068	.172	2.818	.005
TOC_DC	.177	.081	.138	2.192	.029

a. Dependent Variable: ARCAPABILITY

Note: $R^2 = .502$ $R = .709^a$ $F\text{-ratio} = 61.377$ $P\text{-value} = .000^b$

Table 5 presents the stepwise multiple regression analysis of variables related to digital competence and professional development about the action research capability of basic education teachers. It can be inferred that Social and Ethical (Beta = 0.205), Advanced Degree (Beta = 0.168), Self-Efficacy (Beta = 0.197), Professional (Beta =

0.172), and Technological Operations and Concepts (Beta = 0.138) are predictors of the action research capability of basic education teachers. Moreover, the F-value of 61.377, with a corresponding p-value of 0.000, implies that the regression model is statistically significant. The coefficient of determination (R^2) is 0.502, which indicates that 50.2% of the variation in the action research capability of basic education teachers could be attributed to digital competence and professional Development. In comparison, 49.98% were attributed to other variables not included in this study. Therefore, the null hypothesis, which states that "there is no variable that best predicts action research capability of basic education teachers," is rejected.

Several studies support the findings of this study, highlighting the importance of social and ethical competence in digital education. For instance, research highlights that teachers who understand the ethical implications of technology use are better equipped to engage in action research, as they can navigate the complexities of digital environments responsibly (Hollandsworth et al., 2017). This finding aligns with the regression analysis, which revealed that social and ethical considerations emerged as significant predictors of action research capability. Moreover, the attainment of an advanced degree has been linked to enhanced research skills among educators. Studies indicate that teachers with higher educational qualifications often exhibit greater confidence and competence in conducting research, reinforcing the positive relationship between advanced degrees and action research capability (Darling-Hammond et al., 2017). This is particularly relevant in the context of professional Development, where continuous learning is essential for improving teaching practices and research engagement.

Various studies have focused on the relationship between digital competence, professional Development, and action research capability among basic education teachers. Falloon (2020) introduced the Teacher Digital Competency (TDC) framework, which emphasizes the holistic Development of digital skills among educators. This framework highlights how digital competence not only enhances teaching effectiveness but also fosters professional growth, thereby supporting teachers in conducting action research. Similarly, Prudente et al. (2024) conducted a systematic review of professional development programs for teachers in the Philippines. Their findings underscore the critical role of digital competence in empowering educators to engage in action research, particularly in addressing the unique challenges of the Philippine educational landscape. Furthermore, Annemann, Menge, and Gerick (2025) explored the international dimensions of digitalization-related Professional Development. Their study revealed that participation in such programs significantly improves teachers' ability to integrate ICT into their classrooms, which is closely linked to their capacity for action research.

4.0 Conclusion

Based on the findings of the study, the following conclusions are drawn:

The teachers in Maramag 1 District demonstrated an advanced level of digital competence, showcasing proficiency across all domains, including Technological Operations and Concept Domain, Social and Ethical Domain, Pedagogical Domain, and Professional Domain. The basic education teachers exhibited a highly developed level of professional Development in terms of training and seminars attended, self-efficacy, and advanced degrees. The level of action research capability of basic education teachers in terms of selecting a topic for professional growth, planning an action research project, integrating technology in writing literature, integrating ethics in action research, integrating technology in analyzing data, analyzing and presenting action research data, and reflecting and communicating results was at a moderately capable level, demonstrating moderate competence.

There is a significant relationship between digital competence and professional Development to the action research capability of basic education teachers, displaying a range of correlations from moderate to strong. The significance of these correlations ($p < 0.01$) suggests that these relationships are reliable and not due to chance. Hence, the null hypothesis that there is no relationship is hereby rejected. There are variables in combination that predict the action research capability of basic education teachers. Thus, the null hypothesis is rejected.

5.0 Contribution of Authors

This study was successfully co-authored with the researcher's thesis adviser, Gladys S. Escarlos, Ph.D., Professor III of the Academic Paradise of the Southern Bukidnon, Central Mindanao University, University Town, Musuan, Maramag, Bukidnon, Philippines.

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7.0 Conflict of Interest

The author declares no conflict of interest in the publication of this paper. Further, this study was conducted without any financial or personal relationships that could influence the results or interpretation of the study.

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