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Development and validation of a scale on teacher's competence in action research

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Abstract

The Philippine Qualifications Framework (PQF) directs the Commission on Higher Education (CHED) to lay out policies, standards, and guidelines for higher education academic programs, and help basic education teachers by providing them with appropriate professional development (PD) programs. One of the programs referred is training them to reflect on their professional practices by means of action research (AR). However, issues concerning impact evaluation of these PD programs have been raised. This study thus aims to develop a valid and reliable self-report scale to measure competence of teachers in conducting an AR project as one of the tools for impact evaluation. To do so, a scale called TCAR was developed according to constructs of Johnson's (2008) Model of AR. The validity and reliability of the scale were established by examining responses of 166 AR practitioners who are teachers from basic education program. Factor Analysis was performed and confirmed the hypothesized model of AR of which the percentage of variance explained by the scale is 78.161. It retained 54 items which are distributed in seven subscales generated, namely: analyzing and presenting AR data, reflecting on and communicating results, planning an AR project, integrating ethics, selecting topic for professional growth, integrating technology in writing literature, and integrating technology in analyzing data. The Cronbach's alpha was also computed as a measure of internal consistency for the whole scale which results to .988. Thus, findings of this study provide significant evidence for the validity and reliability of TCAR.

Keywords: action research; action research practitioners; competence; scale development; self-report

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1. Introduction

There is a great deal of educational reforms around the world as revealed by a number of comparative studies being done (Levin, 2001). These reforms direct the roles of schools and have profound impact to teachers' professional lives (Madden, Wilks, Maoine, Loader, & Robinson, 2012). This is because teachers should effectively respond in these systemic changes otherwise these can actually be seen as "deforms" which will result to increasing impoverishment and misery to them, and the educational community (Arnove, 2005). In this regard, global interest in promoting professional development (PD) programs has been acknowledged as key mechanism to mobilize these educational reforms (Bautista & Ortega-Ruiz, 2015). One of the programs referred is training teachers to reflect on their practices through action research. It is a form of enquiry which enables a practitioner to investigate, reflect, and eventually improve his work practices, thus, a popular form of professional learning for teaching, but is now applied across other professions (McNiff & Whitehead, 2006).

So far, there are three teacher development programs relating to AR since 2010 have been documented globally (*i.e.* Cullen, Akerson, & Hanson, 2010; Hathorn & Dillon, 2018; Paredes-Chi & Castillo-Burguete, 2018). In the Philippines, PD programs about AR are not well documented although several needs-assessments have been reported (*e.g.* Morales et al., 2016; Ulla, Barrera, & Acompanado, 2017; Cortes, 2019). The transition of the country's basic education curriculum has put the national and local initiatives on teacher trainings about AR into our peripheral vision. Nonetheless, the attention on AR was put into renaissance when the country's Department of Education released several orders to promote and strengthen the culture of research in basic education program in order to build their policies and decisions anchored on evidences. The most recent orders were in 2017 which establishes Research Management Guidelines (RMG) (Department of Education, 2017) and which adopts and implements the Philippine Professional Standards for Teachers (PPST) (Department of Education, 2017). The Philippine Higher Education Institutions are also with these national efforts per mandate of the Philippine Qualifications Framework (PQF) to help the basic education system by providing timely and appropriate PD programs.

However, issues concerning impact evaluation of these programs have been raised. While we have acknowledged and adopted a plethora of analytical frameworks (*e.g.* Guskey, 2002; Clarke & Hollingsworth, 2002; Desimone, 2009) to guide the process in designing, analyzing, and evaluating PD programs, these only provide us potential variables or measures to evaluate which include but not limited to teachers' beliefs, attitudes, knowledge and skills. With these, the PD models might have universal applicability, but these tend be too generic, conceptual, or processual in focus. In the context of teacher training on AR, Evans' (2012) concept of researcher development is regarded as the most appropriate analytical framework for impact evaluation. This model identifies componential structures of the three principal domains or components of researcher development, namely: attitudinal, intellectual, and behavioral. These subcomponents, however, have to be operationally defined specific to the topic being trained because some competencies in AR, for an instance, are distinct with other research methods in the spectrum of traditional educational research. It also holds true to other subcomponents such as the processual, procedural, productive, etc. This study thus aims to operationally define the professional competences in the context AR by developing a valid and reliable self-report scale. The scale intends to measure competential change, one form of researcher development which involves increase of or enhancement of research-related skills and competences, such as the development or refinement of writing, analytical or presentation skills (Evans, 2012). Although this scale will only evaluate one impact of PD program in AR, but this could initiate development of scales for the rest of the componential structures of researcher development in future researches.

2. Methods

2.1 Participants

The researchers recruited teachers from elementary and secondary schools in one of the provinces in Central Visayas, Philippines to test the psychometric properties of TCAR. These teachers have previous trainings and engagement in designing at least an AR project. Prior to the recruitment, a transmittal letter indicating the nature and purpose of the study was sent to the schools' division superintendent as a mode of obtaining consent. Upon approval, the questionnaires were distributed to 187 teachers and 166 were returned, resulting to response rate of 88.70%. The preliminary attachments of these questionnaires were letter of invitation to participate in the survey and informed consent. The latter explains purpose and background of the study, procedures, extent of confidentiality, benefits, and that their participation was voluntary.

2.2 Instrument Development

TCAR was developed following the practical guidelines of Barry, Chaney, Stellefson, and Chaney (2011). The scale thus underwent multiple stages of development and validation which involved (a) outlining the construct(s), (b) developing scale design and structure, (c) generating sample items, and (d) pretesting the scale. These steps characterize the nature of sequential exploratory mixed methods research design which integrates both qualitative and quantitative data with the former being collected initially.

Outlining the Constructs - The initial and critical phase in scale development is to outline the domains or context of the constructs. Note that Evans' (2012) componential structure of researcher development, as shown in Figure 1, may provide these constructs which can be translated into components of researcher development (i.e. behavioral, attitudinal, and intellectual) but each component has further dimensions or subcomponents which make up the constructs. For an instance, behavioral component is composed of processual, procedural, productive, and competential dimensions. However, competential dimension alone in the context of research involves competence in developing a research question, choosing appropriate research design, data collection techniques, analysis, and among others. These competences do not essentially make up other dimensions within behavioral component. To identify these AR competences, an AR model was adopted to identify the steps or process of the research method, and eventually become the basis of the constructs of the scale. This is because the steps also set and describe the relevant competences. In this regard, Johnson's (2008) AR model which is reflected in his book entitled "A Short Guide to Action Research" was used as basis to outline the constructs of the scale. This model, as shown in Figure 2, is a cyclical, continuous, and iterative process of planning, acting, developing, and reflecting. Its strength rests on the apparent display of prescriptive processes which should transpire in all stages of AR, which is from problem conceptualization to professional reflection. Each of this stage eventually directs the pool of items to be created, but their operational definition, reflected in Table 1, have to be delineated as basis for creating the items.

Developing Scale Design and Structure, and Generating Items - The researchers used literature review as a deductive approach in initially generating items within the competences of AR. The review generated 61 items which were distributed in four stages of AR: planning (14 items), acting (29 items), developing (6 items), and reflecting (12 items). All items were worded positively to avoid reverse coding and scoring. Each item was rated on a five-point scale, with 1 as limited, 2 as basic, 3 as proficient, 4 as advanced, and 5 as expert. Although a comprehensive and broad number of items were developed in this stage, the following psychometric tests will eventually remove the items that do not capture the essence of the a priori constructs.

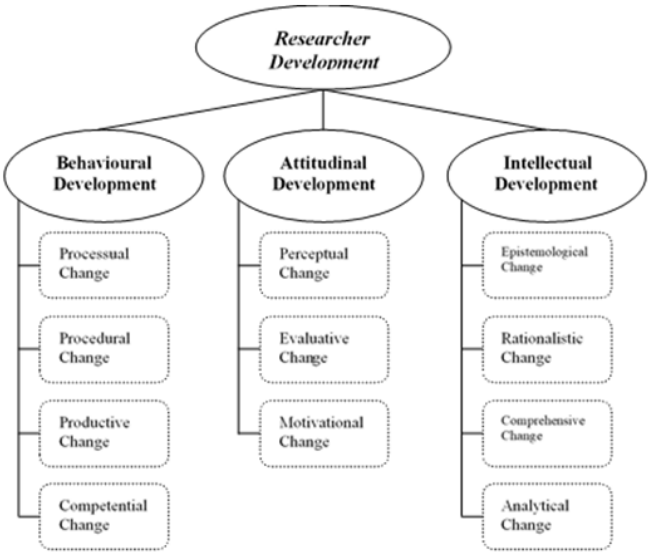

Figure 1. Componential structure of researcher development (Evans, 2012)

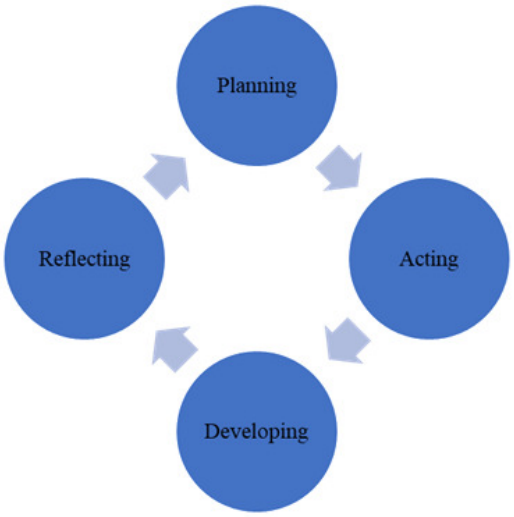

Figure 2. Johnson's (2008) AR Model

Table 1

Table of Specification for Scale Construction

Constructs	Operational definition
Planning	An initial stage in AR characterized by identifying and limiting a topic, reviewing and writing related literature.
Acting	The collection and analysis as well as reporting of results
Developing and Reflecting	The stage to which a teacher reflects on his AR journey. The teacher writes an action plan as a proof of his professional reflection. Finally, it is in this stage which the teacher communicates his results in written or oral form.

Reducing the Items - The panel of experts were composed of one division education specialist in DepEd whose one of the assignments involve training teachers on AR, a graduate student with interest and publications in research instrumentation, and a professor from Normal school who conducts CPD programs in AR. They determined the content validity of the items in the scale by using Aiken's Validity Index (AI) to which each item

was rated on a four-point Likert scale (1 = irrelevant, 2 = needs modification, 3 = relevant, 4 = strongly relevant) to avoid neutral midpoint. After the calculation, the AVI of all items range from 0.78 to 1.00, hence, all are included as the values are classified excellent (Terwee et al., 2007). Subsequently, the scale was purposively administered to 187 teachers of which 166 were returned without missing data. This sample size is considered adequate because 150 cases for exploratory factor analysis (EFA) and 100 for confirmatory factor analysis (CFA) are considered enough provided the inter-item correlation is practically strong (Guadagnoli & Velicer, 1988). In this case, the inter-item correlation ranges from .564 to .864 of all the items. In addition, sampling size adequacy was established by calculating Kaiser-Meyer-Olkin (KMO) which results to .954 and Bartlett's Test of Sphericity which is significant ($p < .000$). The scale was then available for principal component axis factoring to estimate the factorability of the correlation matrix and to determine the number of factors. The factors with Eigen values greater than 1.0 were included. Eventually, the resulting number of factors went through principal components and maximum likelihood analysis through Varimax rotation with Kaiser Normalization as its rotation method. Only items which criterion loading are .5 and above were included in the final factors for pragmatic reason. Finally, Cronbach's alpha was determined to establish the internal consistency of the scale and its factors.

3. Results and Discussion

The factor analysis examined 61 items of the scale. Seven of these items failed to reach the criterion loading set at .50, thus, removed. Meanwhile, three items crossload twice to two factors. The items referred are no. 30 and 31 which both crossload in Factor 6 and Factor 1 but eventually assigned to the latter. Item 35 crossloads to Factor 2 and Factor 3 but assigned to the former. The pragmatic reason for assigning these items to specific factor rests on their apparent alignment or consistency with the other items of the factor. As a result, the factor analysis only retains 54 items which are distributed in seven factors, namely: analyzing and presenting AR data, reflecting on and communicating results, planning an AR project, integrating ethics, selecting topic for professional growth, integrating technology in writing literature, and integrating technology in analyzing data. The total percentage of variance explained by these seven factors is 78.161.

Factor 1 accumulates 61.573 percent of the variance from the total and loads 13 items. The items aggregating in this factor explore teacher's self-report competence to collect, analyze, and present AR data which is identified as the acting stage of Johnson's (2008) AR model, thus named as analyzing and presenting AR data factor. Factor 2 clusters items which investigate teacher's competence in developing an action plan, a period when a teacher puts his professional reflection on the AR process into writing. Although there are 13 items which load in this factor including the items which assess competence to communicate results, the percentage of variance explained is 4.658. This draws a significant margin from Factor 1. As the factoring moves to Factor 3, the combined percent of variance of the items drops to 3.274 but loads 11 items. These items report on teacher's self-perceived competence to design an AR project which is characterized by preliminary activities when doing an AR such as identifying and limiting a topic and reviewing related literature. In this regard, the factor is named planning an AR project.

The items on integrating ethics load in Factor 4 which explains 2.780 and loads eight items. These items were originally assigned and distributed in four stages of action research but eventually grouped into one factor, hence, can be classified as latent factor. The purpose of these items is to let the teacher assess his perceived competence in the ethical guidelines of AR. Factor 5 are items exploring competence on selecting topic for professional growth. In other words, these topics are those relevant in teaching profession. This factor explains 1.365 percent of the variance and loads four items. Finally, Factor 6 and Factor 7 are loading items which evaluate competence to utilize technology in writing literature and analyzing data, respectively. The former explains 1.166 percent of the variance and loads two items while the latter explains 1.053 percent of the variance and loads three items. These items were originally assigned in any of the stages of AR but clustered in separate factors.

The scale reliability as determined by Cronbach's alpha ranges from .855 to .972 within subscales and .988

for the entire scale. All of these reliability coefficients fall into the minimum standards and are classified "very good" (Nunnally, 1978). These results confirm that TCAR has an ideal stability.

Table 2

Teacher's competence in action research survey items (N=166)

#	Factors/Items	Communalities	Mean	SD
	Factor 1. Analyzing and Presenting Action Research Data (α = .972, 13 items, % variance = 61.573)			
19	I can align appropriate statistical test with parametric and nonparametric data to address issues of validity in quantitative action research studies.	.525	2.01	.814
20	I can determine which analysis suits to qualitative data.	.624	2.09	.859
21	I can develop a data collection plan.	.639	2.10	.814
22	I can summarize collected data in a dependable and accurate manner.	.682	2.07	.885
23	I can interpret the underlying meaning or the implication of the data.	.594	2.05	.777
24	I can perform preliminary and iterative steps involving reading, describing, and classifying research data before proceeding to data analysis.	.571	2.09	.823
25	I can identify techniques involved in qualitative data analysis.	.699	2.03	.766
26	I can analyze quantitative data regardless if the test involves descriptive or inferential.	.721	1.99	.828
27	I can identify emerging themes in an inductive analysis of qualitative data.	.658	1.95	.792
28	I can analyze both quantitative and qualitative data in mixed-method research deigns.	.699	2.01	.794
29	I can create a coherent story from all the data collected.	.690	2.01	.722
30	I can make visual display for the reader to easily understand information.	.529	2.15	.836
31	I can present qualitative data in graphs, charts and networks when necessary.	.544	2.15	.864
	Factor 2. Reflecting on and Communicating Results (α = .970, 13 items, % variance = 4.658)			
34	I can identify the distinction between an action plan and the action research process itself.	.531	2.03	.849
35	I can discuss the purpose of an action plan.	.533	2.10	.871
36	I can identify the basic components of an action plan.	.617	2.03	.842
37	I can design an action plan following the "Steps to Action Chart" format.	.643	1.92	.797
38	I can work with an array of people to develop action plan depending on the scope of action research effort.	.600	2.07	.798
39	I can write the action research report in a scholarly manner.	.507	1.98	.746
40	I can formally write an action plan as a complete report for the action research project when considered for publication in a professional journal.	.559	1.95	.749
41	I am aware on the guidelines in academic writing agreed-upon conventions of style (e.g. Publication Manual of the American Psychological Association).	.642	1.93	.803
42	I am aware on the basic organizational structure for formatting an action research report.	.673	1.96	.754
43	I am aware on the fundamental submission guidelines to a research journal when considering an action research project for publication.	.563	1.91	.729
44	I can identify which journals are tagged as credible and predatory.	.542	1.90	.760
46	I can disseminate results of action research in journals and conferences.	.602	1.92	.797
47	I can present information without revealing confidential details regarding participants or location.	.526	1.96	.758
	Factor 3. Planning an Action Research Project (α = .960, 11 items, % variance = 3.274)			
4	I can narrow the research topic to put it in a researchable concept.	.507	2.10	.826
5	I can state research questions in common language.	.577	2.27	.834
6	I can ensure that the topic I will be working on is grounded in the realities of the school.	.619	2.37	.890
8	I can identify what has been done in previous studies and the gaps when choosing a topic.	.515	2.20	.854
9	I can identify underlying assumptions of previous authors on their research questions.	.606	2.10	.788
11	I can evaluate my sources when conducting literature search and review.	.511	2.15	.828
12	I can track and write references of the literature used in the review.	.522	2.27	.897
14	I am aware on the usefulness and limitations of various qualitative data collection tools.	.574	2.13	.902
16	I can conduct research in a systematic and disciplined manner.	.534	2.23	.864
17	I can determine appropriate data sources to establish data triangulation.	.569	2.13	.854
18	I am aware on the usefulness and limitations of various quantitative data collection tools.	.570	2.23	.871

Table 2 …continued

#	Factors/Items	Communalities	Mean	SD
	Factor 4. Integrating Ethics in Action Research (α = .953, 8 items, % variance = 2.780)			
49	I can write an assent form.	.502	2.08	.758
50	I can write letter of consent to parents or legal guardians.	.665	2.33	.896
51	I know the guidelines in securing consent from my immediate head and teacher researchers.	.686	2.18	.869
52	I can examine ethical slippages such as concealment and exaggeration when analyzing data.	.580	2.02	.786
53	I can provide information in the right way to participants.	.628	2.19	.852
54	I can present and disseminate findings in line with ethical guidelines.	.643	2.15	.864
55	I can identify ethical issues which may arise ahead in an action research project (e.g. research topic, method, design of instruments, archiving, etc.).	.697	2.23	.885
56	I can apply the basic principles of ethical research which are stipulated in various codes and guidelines (e.g. The Belmont Report, 1979).	.747	2.19	.885
	Factor 5. Selecting Topic for Professional Growth (α = .855, 4 items, % variance = 2.238)			
1	I can develop a research proposal which support my professional development.	.593	1.99	.798
2	I can choose questions which interest my teaching colleagues, counselors, and administrators.	.710	2.21	.761
3	I know how to choose list of topics which are of interest to me before selecting the one.	.656	2.28	.899
7	I can take literature search and review on my proposed topic.	.548	2.24	.825
	Factor 6. Integrating Technology in Writing Literature (α = .886, 2 items, % variance = 1.912)			
60	I can use search engines to explore internet sites which will build my review of related literatures.	.669	2.33	.870
61	I can use technology when doing bibliographical entries in Microsoft Word.	.699	2.31	.933
	Factor 7. Integrating Technology in Analyzing Data (α = .909, 3 items, % variance = 1.727)			
57	I can operate computer software in analyzing qualitative data (e.g. NVivo 10.0).	.824	1.92	.824
58	I can operate computer software in analyzing quantitative data (e.g. SPSS).	.813	1.90	.818
59	I can operate software programs for analyzing mixed-method data (e.g. Dedoose).	.738	1.80	.735

Note. Overall α = .988, Kaiser-Meyer-Olkin Measure of Sampling Adequacy = .954, Bartlett's Test of Sphericity = 13,199.766, $p < .000$, df = 1830, Total Variance = 78.161%

3.1 Implications for teacher training practices

Findings from this study provides us a valid and reliable self-report scale which can examine teacher's self-perceived competence in AR. Hence, one of the new contributions of the present study is to provide a quantitative scale which can assess teacher's competence held and competential changes, respectively, before and after a teacher will undergo a professional development program relating to AR. The scale specifically lays out necessary competences which are stated into items. Hence, if used as a tool for needs assessment, AR trainors may be guided on which specific competences need to be focused and improved by the teachers if they are planning for a professional training. In addition, the current study may also have implications for training policies of the Philippine Department Education, a government agency responsible for ensuring quality in basic education program. Currently, the department's research management guidelines (RMG) has a unified framework in the quality evaluation of AR proposals proposed by their teachers but it has not laid out an evaluation framework for training effectiveness on AR. Then, this developed scale may be integrated into the department's RMG as one of the tools which will evaluate perceived needs of the teachers in AR. Finally, this study may also have implications for pre-service teacher trainings. The 2017 policies, standards and guidelines for both elementary and secondary education integrated AR as a content course. In this regard, the developed scale may be used by the course professor to examine the needs of pre-service teachers in AR and evaluate their developments after taking the course.

4. Conclusion

The findings of this study reveal TCAR as a valid and reliable self-report scale. It operationally defines the specific competences in action research, namely: analyzing and presenting AR data, reflecting on and communicating results, planning an AR project, integrating ethics, selecting topic for professional growth, integrating technology in writing literature, and integrating technology in analyzing data. These competences are essential in facilitating the evaluation of needs and professional development of teachers, respectively, who will undertake and undertook a professional development program in AR. To our knowledge, this is the first on the literature that one of Evans' components of researcher development is defined in the context of a quantitative self-perceived scale. In addition, this scale will eventually initiate the development and validation of other scales for the rest of the componential structures of researcher development in the context of AR in future researches. In the meantime, the scale can be used by professionals who train teachers on AR and by university lecturers who teach pre-service teachers on AR when evaluating competential needs and competential changes for an AR professional development program and AR course of teachers and students. TCAR is relevant beause effective professional development programs will rely on sound empirical data from needs assessment and impact evaluation.

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