Secondary School Teachers Research Knowledge with Respect to Their Teaching Subjects of Mathematics, Physical Science, Biological Sciences and Teaching Experience

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Abstract: The purpose of this research was how secondary school teachers' research knowledge was affected by their teaching subjects and teaching experience. The data was collected using the normative survey method, with 120 secondary school teachers with M.Ed/M.Phil./Ph.D. degrees constituting up the sample. RKT was developed by a researcher (Research knowledge test for teachers) The tool's reliability coefficient is 0.72, which suggests that it has an adequate reliability value, and the Guttmann coefficient value 0.71 which suggests good reliability was established. The present research reveals that teachers' research knowledge did not significantly differ depending on the subject taught, and that there was a significant difference in research knowledge between teachers with less than 5 years of teaching experience and teachers with more than 5 years of teaching experience.

Keywords: Research Knowledge, Teaching Subjects, Mathematics, Physical Science, Biological Sciences. Teaching Experience

1.0 Introduction

Every nation depends on the teachers, if the teachers have research knowledge that nation can be rapid development at different areas like science and technology, industries, medical field, solar system, agriculture, communication, etc. A teacher is required to have good research knowledge because of rapidly changing Science and technology in everyday life and able to take considered positions on science related Issues of social importance. Only scientific developments can respond to needs of nation in order to improve the quality of life of the majority population. The teachers who possess research knowledge ultimately develop the scientific attitude among their students, teacher's research knowledge depending on the different characteristics like Commitment, personality, discipline, curiosity, etc. Science teachers we to question through questioning only we can establish scientific knowledge, curiosity encourage the students to know about science. The level of development of any country is largely on the levels of scientific knowledge progress in science depends upon the continuous scientific investigations many researchers have reported that, well-organized and well-equipped laboratories are essential in science

teaching. Science teachers is mainly responsible for developing scientific attitude among the student's teacher should provide opportunities for wide reading, conducting activities, doing practical work and making models. it can be developed how to solve the problems, ideas, logical thinking and make decisions. Some students have developed negative stereotypes of science (Rogers and Ford 1997).

Every classroom is different. It is this complexity in which they operate in that provides a compelling reason for teachers to look more closely into their own teaching practice. One way for them to do so is to conduct research, right in their own classroom. Research can help the teachers to face new challenges and become better practitioners. When it comes to teaching, it cannot be left to a certain magic formula (Hairon Salleh, 2014).

1.1. Importance of Research in Education

Research involves reviewing the literature, specifying a purpose for the study, collecting and analyzing data, and forming an interpretation of information. This process culminates in a report, disseminated to audiences that is evaluated and used in the educational community (Creswell, 1998). Research is a common endeavour to search for knowledge. It is to search for pertinent information on a specific problem in a scientific way. Human knowledge as it exists today broadly consists of facts and theories, new facts, concepts and new ways of doing things increased its quantum with the passage of time. This knowledge enables us to understand, comprehend, explain, control, and cope with given situation. The sources from which we obtain knowledge range from those that are highly reliable to those that are completely unreliable. The knowledge obtained from the unreliable sources is based on assumptions, beliefs and untested generalizations. Such generalizations are usually accepted on faith, tradition, authority and no effort is made to verify their validity. In contrast reliable knowledge is based on objective verification of generalizations.

The basis for educational research is the scientific method. The scientific method uses directed questions and manipulation of variables to systematically find information about the teaching and learning process. In this scenario questions are answered by the analysis of data that is collected specifically for the purpose of answering these questions. Hypotheses are written and subsequently proved or disproved by data which leads to the creation of new hypotheses. The two main types of data that are used under this method are qualitative and quantitative. Qualitative research uses the data which is descriptive in nature. Tools that educational researchers use in collecting qualitative data include: observations, conducting interviews, conducting document analysis, and analyzing participant products such as journals, diaries, images or blogs. Types of qualitative research are Case study, Ethnography, Phenomenological Research , Narrative Research and Historical Research. Quantitative research uses data that is numerical and is based on the assumption that the numbers will describe a single reality. Statistics are often applied to find relationships between variables. Types of quantitative research are Descriptive Survey Research, Experimental Research, Single Subject Research, Causal Comparative Research, Co relational Research.

If teachers involve in research, they can find themselves faced with new and novel demands, existing models to guide them. The teachers continually learn as they teach. Instead of reusing the same old teaching strategies that have worked in the past, they may have to come up with innovative ways of teaching. Not only that, teachers are also encouraged to come up with their own curriculum initiatives. The advantage of teacher research is that it brings teacher learning and teaching really close together. When teachers attend workshops and seminars and hear about new teaching ideas, they would be thinking to themselves: "How do I translate this in my classroom?" More often than not, something gets lost in the translation. Another way research can help teachers in their work is how it clarifies and even challenges,

their own beliefs and assumptions about teaching and learning. This happens very early on in the research process, when they are formulating their research questions.

Objectives of Education are to inculcate interests, values, attitudes, aptitudes and appreciation among the learners. Educators have recognized that scientific attitude is an important outcome of science education. Without developing scientific attitude, any amount of knowledge is likely to contribute no change. Scientific attitude is a complex behavioural aspect of science. One can use it to associate with various subjects and its impact on learning and achievement, one can relate it with sex, residence, type of school, teaching and learning situations, physical facilities so on. Science subject in curriculum provides certain values which are not provided by any other subject. It affords knowledge of certain facts and laws and an insight into methods. The teaching of science imparts training in the scientific method and develops scientific attitude which are very valuable and at the same time are transferable to other situations of life.

2.0. Review of related literature

- Fullan (2013) found that one of the critical factors for more frequent innovative education is that teachers engaged in "professional development activities that involve the active and direct engagement of teachers", such as teachers conducting research or directly practicing new methods.
- Clausen, Aquino & Wideman (2009) studied on a learning community model which requires teachers to carry out research projects and reflect on their own practice during and after the projects, besides just acquiring knowledge from university experts outside school.
- Watkin's (2006) findings concluded from his interview with teachers that research is not something every teacher is keen on engaging themselves in. This view of educational research is very prevalent among teachers in Hong Kong, who tend to believe that research is solely done by university scholars, and they have a minimal role to play in it.
- Furlong & Salisbury (2005) studied on teacher research. Study showed teachers research knowledge have positive effects on the professional competence of teachers since action research is a necessary and an integral part of the process of developing teaching as an evidence-based profession
- Berger, Boles and Troen's (2005) study found that teachers were unfamiliar with or even intimidated by the concept of research. Some teachers were resentful of the idea of conducting teacher research as they regarded it as something "complex" and "sophisticated" such that only academics at universities could do (Campbell, 2003).

- Shulman (1987) coined the phrase *pedagogical content knowledge* to describe the knowledge teachers need in order to make subject matter comprehensible to students. Researcher called it a "special amalgam of content and pedagogy that is uniquely the province of teachers".

3.0 Objectives of the study

- To find out the levels of secondary school teachers' research knowledge.
- To find out the influence of Teaching subject and teaching experience on their research knowledge.

4.0 Hypotheses of the Study

1. The level of Teachers' research knowledge is low
2. There is no significant difference in the Knowledge on Research Methods of Secondary School Teachers with respect to subject taught.

3. There is no significant difference in the Knowledge on Research Tools of Secondary School Teachers with respect to subject taught.
4. There is no significant difference in the Knowledge on Sampling Methods of Secondary School Teachers with respect to subject taught.
5. There is no significant difference in the Knowledge on Data Processing & Statistical procedure of Secondary School Teachers with respect to subject taught.
6. There is no significant difference in the Overall Research Knowledge of Secondary School Teachers with respect to subject taught.
7. There is no significant difference in the Knowledge on Research Methods of Secondary School Teachers with respect to teaching experience.
8. There is no significant difference in the Knowledge on Research Tools of Secondary School Teachers with respect to teaching experience.
9. There is no significant difference in the Knowledge on Sampling Methods of Secondary School Teachers with respect to teaching experience.
10. There is no significant difference in the Knowledge on Data Processing & Statistical procedure of Secondary School Teachers with respect to teaching experience.
11. There is no significant difference in the Overall Research Knowledge of Secondary School Teachers with respect to teaching experience.

5.0 Method used in the study

The investigator has selected a suitable research method called 'Normative Survey Method' for the present study.

6.0 Sampling

The investigator contacted and obtained permission from the Principals/Heads of the secondary schools selected for data collection. The permission from the concern authorities was obtained to collect data from the participants. The willingness and co-operation of the teachers were also sought. The data on research knowledge were collected personally by the investigator from selected 120 teachers randomly. Secondary school teachers, who hold M.Ed./M.Phil./Ph.D. degrees teaching Mathematics, Physical Sciences, and Bio Sciences of Telangana state including constitute the population of teachers for the present study. The investigator adopted simple random sampling technique to identify the teachers for collection of the data for the present study. Teachers were selected on the basis of Simple Random Sampling Technique, and their students were also randomly taken.

7.0 Development of the Tool

Researchers developed the tool Research Knowledge Test (RKT) for the teachers. It consists of 51 multiple choice questions. It was constructed by the researcher to study the levels of research knowledge of the secondary school teachers. The researcher reviewed a lot of literature and consulted the teachers to frame the items in the tool. Keeping in view of the objectives and nature of the study, the items for the RKT were generated on four important content areas of research methods, research tool, sampling process and data processing techniques. The test consists of 51 multiple choice type questions. Each item has four options of answers out of which only one answer is correct and for each correct answer carries 1 mark. The reliability coefficient of the tool according to Cronbach's alpha 0.72, which indicates it is acceptable reliability value, the tool was evaluated by experts. Hence content validity was established.

8.0 Data analysis on Levels of Teacher's Research Knowledge

The total scores on Research Knowledge Test were categorized using the Normal Probability Curve (NPC). The descriptive statistics for the test of Mean and SD are used to form three groups of teachers viz., Low-Level Research Knowledge Teacher group (Minimum score to Mean-SD score), Moderate level Research Knowledge Teacher group (Mean-SD score to Mean + SD score) and High-level Research Knowledge Teacher group (Mean + SD score to Maximum score).

Table-1: Shows the different levels of Research Knowledge of Teacher groups.

Level of Research Knowledge	Frequency	Percent	Cumulative Percent
Low (below 25)	27	22.5	22.5
Moderate (25 to 41)	63	52.5	75.0
High (above 41)	30	25.0	100.0
Total	120	100.0	

Table-1 shows that there are 22.5% of the teachers are having low level of Research Knowledge, 52.5% of the teachers are having moderate level of Research Knowledge and 25% teachers are with high level of Research Knowledge.

9.0 Teaching Subject and Teachers Research Knowledge

One way ANOVA (F-test) is applied to test the null hypotheses. The Mean, SD for the three groups on each dimension have been computed considering the scores on tool - RKT. The summary & Scores of ANOVA for each dimension is presented in the table-2.

Table-2: Shows ANOVA for scores on dimensions of Teachers' Research Knowledge among different teaching subjects

Dimensions	Teaching subject-Categories	N	Mean	SD	Source	Sum of Squares	df	Mean Square	F-ratio
1. Research Methods	Mathematics	50	12.10	3.67	Between Groups	10.958	2	5.479	0.350#
	Physical sciences	30	12.46	4.71	Within Groups	1832.367	117	15.661	
	Biological science	40	12.80	3.67	Total	1843.325	119		
	Total	120	12.425	3.93					
2. Research tools	Mathematics	50	8.26	2.57	Between Groups	2.030	2	1.015	0.130#
	Physical sciences	30	8.23	3.23	Within Groups	910.962	117	7.786	
	Biological science	40	8.52	2.68	Total	912.992	119		
	Total	120	8.34	2.76	Total				
3. Sampling techniques	Mathematics	50	4.26	1.30	Between Groups	5.297	2	2.648	1.506#
	Physical sciences	30	4.70	1.51	Within Groups	205.695	117	1.758	
	Biological science	40	4.17	1.19	Total	210.992	119		
	Total	120	4.34	1.33					
4. Data Processing & Statistical procedure	Mathematics	50	7.22	2.15	Between Groups	8.937	2	4.468	1.066#
	Physical Sciences	30	7.90	1.78	Within Groups	490.655	117	4.194	
	Biological science	40	7.37	2.08	Total	499.592	119		
	Total	120	7.44	2.04					
Overall Research Knowledge	Mathematics	50	31.84	8.24	Between Groups	46.305	2	23.152	0.302#
	Physical sciences	30	33.30	10.29	Within Groups	8957.395	117	76.559	
	Biological science	40	32.87	8.08	Total	9003.700	119		
	Total	120	32.50	8.69					

Not significant

From the table-2, it can be seen that the details of the ANOVA results on the secondary school teachers' knowledge on Research Methods with respect to their teaching subjects Mathematics, Physical Science and Biological Science based on between groups and within groups, the df values 2, 117; Mean scores are 12.10, 12.46 and 12.80 respectively; standard deviation scores are 3.67, 4.71 and 3.67 respectively and mean squares are 5.47 and 15.66. The calculated F-ratio is found to be 0.350, which is less than the table value of 3.07. Hence, the formulated null hypothesis is accepted. Therefore, it may be

concluded that there is no significant mean difference among Mathematics, Physical Science and Biological Science secondary school teachers in their knowledge on Research Methods.

It can be shown that the details of the ANOVA results on the secondary school teachers' knowledge on Research tools with respect to their teaching subjects Mathematics, Physical science and Biological science based on between groups and within groups, the df values 2, 117; Mean scores are 8.26, 8.23 and 8.52 respectively; standard deviation scores are 2.57, 3.23 and 2.68 respectively and mean squares are 1.01 and 7.78. The calculated F-ratio is found to be 0.130, which is less than the table value of 3.07. Hence, the formulated null hypothesis is accepted. Therefore, it may be concluded that there is no significant mean difference among Mathematics, Physical science and Biological science secondary school teachers in their knowledge on Research Tools.

It can be revealed that the details of the ANOVA results on the secondary school teachers' knowledge on Sampling Techniques with respect to their teaching subjects Mathematics, Physical science and Biological science based on between groups and within groups, the df values 2, 117; Mean scores are 4.26, 4.70 and 4.17 respectively; standard deviation scores are 1.30, 1.51 and 1.19 respectively and mean squares are 2.64 and 1.75. The calculated F-ratio is found to be 1.50, which is less than the table value of 3.07. Hence, the formulated null hypothesis is accepted. Therefore, it may be concluded that there is no significant mean difference among Mathematics, Physical science and Biological science secondary school teachers in their knowledge on Sampling Techniques.

From the same table, it can be revealed that the details of the ANOVA results on the secondary school teachers' knowledge on Data Processing and Statistical Procedures with respect to their teaching subjects Mathematics, Physical science and Biological science based on between groups and within groups, the df values 2, 117; Mean scores are 7.22,7.90 and 7.37respectively; standard deviation scores are 2.15,1.78 and 2.08 respectively and mean squares are 4.46 and 4.19. The calculated F-ratio is found to be 1.06, which is less than the table value of 3.07. Hence, the formulated null hypothesis-4.2.0(iv) is accepted. Therefore, it may be concluded that there is no significant mean difference among Mathematics, Physical science and Biological science secondary school teachers in their knowledge on Data Processing and Statistical procedure.

It can be revealed that the details of the ANOVA results on the secondary school teachers over all research knowledge with respect to their teaching subjects Mathematics, Physical science and Biological science based on between groups and within groups, the df values 2, 117; Mean scores are 31.84, 33.30 and 32.87 respectively; standard deviation scores are 8.24, 10.29 and 8.08 respectively and mean squares are 23.15 and 76.15. The calculated F-ratio is found to be 0.30, which is less than the table value of 3.07. Hence, the formulated null hypothesis is accepted. Therefore, it may be concluded that there is no significant mean difference among Mathematics, Physical science and Biological science secondary school teachers in their overall research knowledge.

10.0 Teaching Experience and Teachers Research Knowledge

To test the null hypotheses, t-test is applied. The Mean, SD for the two groups on each dimension have been computed considering the scores on RKT. The summary & Scores of t-test for each dimension is presented in the table-3.

Table-3: Shows mean, SD and 't' values on Dimension wise Teachers Research Knowledge with respect to their teaching experience

Dimensions	Teaching Experience-Categories	N	Mean	Std. Deviation	t-value
1. Research Methods	Below 5 years	60	10.80	3.48	4.94**
	5 years & above	60	14.05	3.70	
2. Research tools	Below 5 years	60	7.01	2.60	5.95**
	5 years & above	60	9.66	2.25	
3. Sampling techniques	Below 5 years	60	3.90	1.13	3.83**
	5 years & above	60	4.78	1.37	
4. Data processing & statistical procedures	Below 5 years	60	6.65	1.84	4.57**
	5 years & above	60	8.23	1.94	
Overall Research Knowledge	Below 5 years	60	28.36	7.43	5.99**
	5 years & above	60	36.73	7.85	

** Significant at 0.01 level

From the table, it can be seen that the mean scores of Below 5 years teaching experienced teachers and 5 years & above teaching experienced teachers with respect to Knowledge on Research Methods are 10.8, 14.05 respectively; SDs are 3.48, 3.70 respectively. The obtained 't' value found to be 4.94, which is greater than that of table value and significant at 0.01 level for the degrees of freedom 118. This shows that there is a significant difference in knowledge on Research methods between below 5 years teaching experienced teachers and 5 years & above teaching experienced teachers. Hence, the null hypothesis is rejected. It can be concluded that 5 years & above teaching experienced teachers significantly higher than below 5 years teaching experienced teachers in their Research knowledge on different Research Methods.

From the same table, it can be seen that the mean scores of below 5 years teaching experienced teachers and 5 years & above teaching experienced teachers with respect to Knowledge on Research Tools are 7.01, 9.66 respectively; SDs are 2.60, 2.25 respectively. The obtained 't' value found to be 5.95, which is greater than that of table value and significant at 0.01 level for the degrees of freedom 118. This shows that there is a significant difference in knowledge on Research Tools between below 5 years teaching experienced teachers and 5 years & above teaching experienced teachers. Hence, the null hypothesis is rejected. It can be concluded that 5 years & above teaching experienced teachers significantly higher than below 5 years teaching experienced teachers in their knowledge on Research Methods.

From the same table-4.3.0, it can be seen that the mean scores of Below 5 years teaching experienced teachers and 5 years & above teaching experienced teachers with respect to Knowledge on

Sampling techniques are 3.90, 4.75 respectively; SDs are 1.13, 1.37 respectively. The obtained 't' value found to be 3.83, which is greater than that of table value and significant at 0.01 level for the degrees of freedom 118. This shows that there is a significant difference in knowledge on Sampling Techniques between below 5 years teaching experienced teachers and 5 years & above teaching experienced teachers. Hence, the null hypothesis is rejected. It can be concluded that 5 years above teaching experienced teachers significantly higher than below 5 years teaching experienced teachers in their knowledge on Sampling Techniques.

From the same table, it can be seen that the mean scores of Below 5 years teaching experienced teachers and 5 years & above teaching experienced teachers with respect to Knowledge on Data processing and Statistical Procedures are 6.65, 8.23 respectively; SDs are 1.84, 1.94 respectively. The obtained 't' value found to be 4.51, which is greater than that of table value and significant at 0.01 level for the degrees of freedom 118. This shows that there is a significant difference in knowledge on Data processing and Statistical Procedures between below 5 years teaching experienced teachers and 5 years & above teaching experienced teachers. Hence, the null hypothesis is rejected. It can be concluded that 5 years & above teaching experienced teachers significantly higher than below 5 years teaching experienced teachers in their knowledge on Data processing and Statistical Procedures

From the same table, it can be seen that the mean scores of Below 5 years teaching experienced teachers and 5 years & above teaching experienced teachers with respect to overall research knowledge are 28.36, 36.73 respectively; SDs are 7.43, 7.83 respectively. The obtained 't' value found to be 5.99, which is greater than that of table value and significant at 0.01 level for the degrees of freedom 118. This shows that there is a significant difference in Overall Research Knowledge between below 5 years teaching experienced teachers and 5 years & above teaching experienced teachers. Hence, the null hypothesis-4.3.0(v) is rejected. It can be concluded that 5 years & above teaching experienced teachers significantly higher than below 5 years teaching experienced teachers in their overall research knowledge.

10.0 Conclusions and Discussion

Majority of the teachers (52.5%) are having moderate level of Research Knowledge. There is no significant mean difference among Mathematics, Physical science and Biological science secondary school teachers in their knowledge on Research Methods, Research Tools, Sampling Techniques, Data Processing and Statistical procedure and overall research knowledge. There is a significant difference in knowledge on Research methods, Research Tools, Sampling Techniques, Data processing and Statistical Procedures and Overall Research Knowledge with respect to their teaching experience.

In this study, teachers' research knowledge is analyzed on the basis of appropriate sample data collection. One of the objectives of the study is to know the level of teachers' research knowledge. The results indicate that more than 50% of the teachers are having moderate level of research knowledge. According Hairon (2014), Teachers Research knowledge brings teacher learning and teaching close together. Teachers can develop more classroom teaching strategy. It can be recommended that teachers working in secondary schools should be encouraged by the government to carry out small research projects to develop their research knowledge to make teaching learning effective.

The results indicate that there is no difference in teachers' research knowledge with respect to their teaching subject. But the study shows there is a difference exists in teachers research knowledge with respect to their teaching experience. It is suggested that training and research orientation should be given to the teachers irrespective of their, teaching experience.

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