

EXPLORING RELATIONSHIP BETWEEN CONTENT KNOWLEDGE OF SECONDARY SCHOOL SCIENCE TEACHER WITH THEIR PEDAGOGICAL COMPETENCY: CHALLENGES TO SCIENCE TEACHER EDUCATION

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Abstract

In science education content knowledge and pedagogical competency of teacher determines the quality of teaching. Both content clarity and pedagogical competency are essential on the part of science teacher. From recent studies it is found that content knowledge and pedagogical competency of science teacher is not up to mark. However it is really one challenge to science teacher education system to explore the kind of relation existing between content knowledge and pedagogical competency .i.e. whether content knowledge of science teacher helps in developing pedagogical competency. so that it can prepare several strategies to solve problem of low content knowledge and pedagogical competency of science teacher. For the present descriptive type study 200 science teachers were taken as sample from undivided Cuttack, Puri, Balasore districts of Odisha state. One self developed questionnaire and a observation schedule were constructed to map the content knowledge and pedagogical competency of science teacher It is found from this study that there exist positive correlation between Content knowledge and pedagogical Competency of Science teacher. Further it suggested to what kind of strategies should be developed by teacher education system to nurture content knowledge and pedagogical competency of science teacher.

Key Words: *Relationship, Content Knowledge, Pedagogical Competency, Science Teachers*

Introduction

The task of the science teacher in science education is unquestionable. Because, in recent times the subject Science is considered as important field of knowledge and experience. In secondary school education, it has attained compulsory place because of its wide application in daily life as well as for providing vast scope to follow livelihood. To make students obtain worth knowledge, understanding, and skill in such a noteworthy subject field the role of the science teacher is very essential as well as significant. Science teachers provide a framework to help children to think in scientific ways. Science teacher also creates an environment in which learners learn scientifically and develops understanding over content, acquire reasoning power, nurture problem solving capacity plus critical thinking as well as widen students' mental horizon in propagating scientific attitude and scientific temperament. A recent review of the research on teacher quality conducted over the last 20 years revealed that, among those who teach math and science, having a major in the subject taught has a significant positive impact on student achievement. (Panda 2012).Teacher's understanding in their teaching matter also affects

student's opportunity to learn.(Grossman1988;Limpert, 1986) Therefore science teachers need to develop good content knowledge to carry out such an important task of teaching science effectively to students. Similarly Pedagogical competency of Science teachers determines how far he/she is able to teach science and achieve the objectives of science education. Pedagogical competency of science teacher is also essential for effective science teaching. These two qualities are though needed on the part of science teacher but it is also significant to know the relationship between content knowledge and pedagogical competency at secondary level in odisha state. It is really important to explore the relationship between these two factors in terms of their correlation coefficient to know how one factor is related to another.

Conceptualization of Content Knowledge and Pedagogical Competency

. Content knowledge means conceptual knowledge of the subject or in depth knowledge of subject. In other words content knowledge is the base of teaching learning process through which teacher achieves aim, objective and goal of teaching. Thus one of the significant determinants of effective science teaching is science teacher's content knowledge in science subject. Content knowledge helps and encourages science teacher to reflect on their own teaching and also to develop deeper insight into their understanding of science subject Panda (2012). It provides means to help students in a scientific way with reference to clearing doubts and queries raised by the learners. Teachers' subject matter knowledge has been considered as an important component of teaching expertise. As Shulman (1986) introduced three components of content knowledge: subject matter content knowledge, pedagogical content knowledge, and curricular content knowledge. Kennedy (1990) addressed three aspects of subjects: the content of the subject, the organization of the content, and the methods of inquiry used in the subject. .

Pedagogical competency of science teacher means ability and capacity to apply as well as use knowledge, skills, attitude effectively by adopting new circumstances for correct instructive strategies in science in a genuine teaching learning situation with perseverance .Pedagogical competency of science teacher should not be considered as only the ability to perform skills in a class. It is broader terms which not only include several teaching skills required for a science teacher but also some other factors constitute this wide field(Panda, Mohalik2013). .

Rationale of the Study

Hashweh (1987) reported that possessing good subject matter knowledge positively affect the range of aspects, considered essential to good science teaching. Carlsen (1988) reported that depth content knowledge develops pedagogical content knowledge (PCK). Dejong ,Van Driel and Verloop (2005), provide evidence good subject matter knowledge helps successful teaching. Muhammad Saeed and Khalid Mahamood (2002) found that teachers have low level of competence in three areas of math, science and pedagogy. Aydin, Bozz (2012) found that the pre-service teachers have misconceptions related with the structure of matter subject affected the development of "student understanding" which is one of the sub-dimensions of pedagogical content knowledge. Tobin and Garnett (1988), and Cochran (1997) claim that content knowledge is essential to good science teaching and to student understanding. The above studies made researchers suspect if there lies any relationship between content knowledge of science teachers and their pedagogical competency..

Therefore, the investigator raised following research question:

Is there any relation exist between content knowledge and pedagogical competency of science teacher?

Objective of the Study

The objective of study is to find out relationship between content knowledge and pedagogical competency of science teachers.

Hypotheses of the Study

The hypothesis of the study is “There will be no significant relationship between content knowledge and pedagogical competency of science teachers”.

Methodology

Descriptive research methodology is adopted to carry out the research.

Sample

200 science teachers were taken as sample from undivided cuttack, Puri , Balasore districts of Odisha state using stratified random sampling.

Tools

Self developed questionnaire and Observation schedule is developed to assess the content knowledge and pedagogical competency of science teacher. The the face and content validity is ensured for both the tools. Reliability is found to be 0.99 for questionnaire and 0.82 for observation schedule.

Analysis, Interpretation and Findings

To calculate the product moment correlation coefficient the scores obtained by 200 science teachers in CK is correlated with their respective PC score and appropriate formula is applied to find the value of ‘r’. product moment correlation of CK and PC of 200 secondary school science teach found to be 0.825, which is significant at 0.01 (0.25) level. Thus null hypothesis i.e. “there will be no significant relation between content knowledge and pedagogical competency of science teachers” is rejected. The alternative hypothesis i.e. “there will be significant relation between content knowledge and pedagogical competency of science teachers”. It can be said that there lies strong positive correlation between content knowledge and pedagogical competency of science teacher.

It is found that there exists significant positive correlation between content knowledge and pedagogical competency of a science teacher. That means teacher having good content knowledge also possess proper pedagogical competency in science teaching and vice versa. These means to show better level of pedagogical competency a science teacher must possess high level of content knowledge. It is strongly supported by several other researchers Mukhopadhyaya (2013), Isah, Jummaj (2011), Weiss and Miller (2006) , Alonzo and Alicia (2002), Sapre (1993).

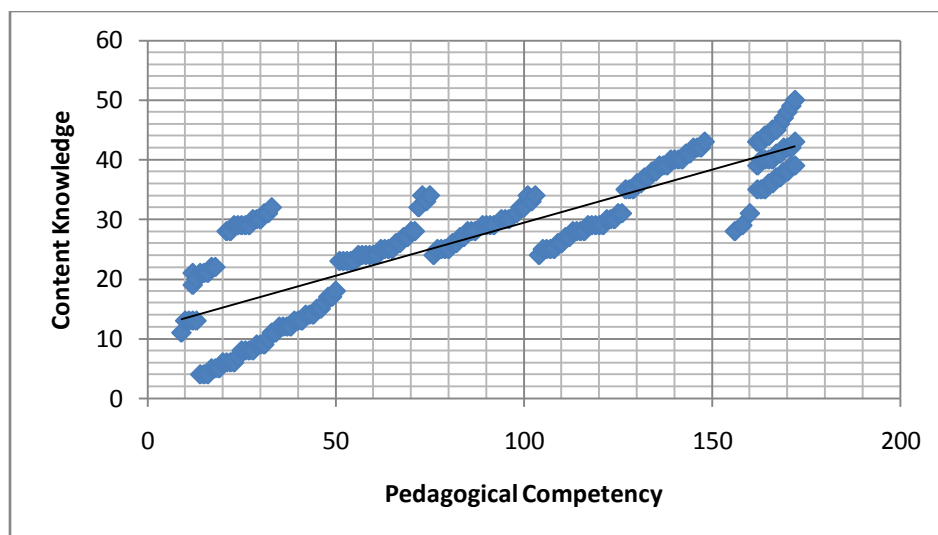


Fig 1: Scatter gram plotting scores of science teachers in CK and PC

From the figure -1 it is evident that there exist positive correlation between content knowledge and pedagogical competency of science teacher. The relation is positive linear correlation. All the points plotted in one direction and a straight line is drawn. It denotes that teacher who scored high in CK also scored high PC and a teacher who scored low also scored low in PC. Hence it is evident there lies positive correlation between content knowledge and pedagogical competency of a science teachers.

The table - 1 denotes the correlation coefficient of teachers according to their sex, age, qualification, and teaching experience. It is evident from the table that in each category there exist strong correlation between teachers' content knowledge and pedagogical competency. It is also clear that there lies positive relation between content knowledge and pedagogical competency of a science teacher. That means teacher having good content knowledge also possess proper pedagogical competency in science teaching.

Table-1: Product moment correlation coefficient of teachers with respect to their scores in content knowledge and pedagogical competency

| SL. No | Group | N | r | Interpretation | Critical value of r at 0.05 level | Critical value of r at 0.01 level | Result |
|--------|--|-----|------|---------------------------|-----------------------------------|-----------------------------------|------------------------------------|
| 1 | CK of male teacher PC of male teacher | 100 | 0.85 | High positive correlation | 0.19 | 0.25 | Significant at 0.05 and 0.01 level |
| 2 | CK of female teacher PC of female teacher | 100 | 0.95 | High positive correlation | 0.19 | 0.25 | Significant at 0.05 and 0.01 level |
| 3 | CK of teachers with upto age 35 PC of teachers with upto 35 age | 53 | 0.98 | High positive correlation | 0.27 | 0.35 | Significant at 0.05 and 0.01 level |
| 4 | CK of teachers with 36 to 45 age PC of teachers with 36 to 45 age | 65 | 0.76 | High positive correlation | 0.24 | 0.31 | Significant at 0.05 and 0.01 level |
| 5 | CK of teachers with more than 45 age PC of teachers with more than 45 age | 82 | 0.97 | High positive correlation | 0.21 | 0.28 | Significant at 0.05 and 0.01 level |

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|----|--|-----|------|---------------------------|------|------|------------------------------------|
| 6 | CK of teachers with qualification B.Sc., B.Ed., PC of teachers with qualification B.Sc., B.Ed., | 115 | 0.81 | High positive correlation | 0.17 | 0.23 | Significant at 0.05 and 0.01 level |
| 7 | CK of teachers with qualification M.Sc., B.Ed PC of teachers with qualification M.Sc., B.Ed | 85 | 0.91 | High positive correlation | 0.21 | 0.27 | Significant at 0.05 and 0.01 level |
| 8 | CK of teachers with upto 10 years of teaching experience PC of teachers with upto 10 years of teaching experience | 39 | 0.98 | High positive correlation | 0.37 | 0.40 | Significant at 0.05 and 0.01 level |
| 9 | CK of teachers with 11 to 20 years of teaching experience PC of teachers with 11 to 20 years of teaching experience | 70 | 0.81 | High positive correlation | 0.27 | 0.30 | Significant at 0.05 and 0.01 level |
| 10 | CK of teachers with more than 20 years of teaching experience PC of teachers with more than 20 years of teaching experience | 91 | 0.96 | High positive correlation | 0.20 | 0.26 | Significant at 0.05 and 0.01 level |

It is found from the study that PC of teachers is dependent on CK. This may be due to several reasons. The method they selected, implemented appropriately in classroom is supported by their knowledge in depth in science content as well as related scientific laws, principles in theories. While selecting teaching learning material also the conceptual clarity in content is required. The good content knowledge develops confidence among the science teacher to plan, use, and implement appropriate science pedagogy in secondary school classroom. In addition to this teachers who have good knowledge in science subject could solve the doubts and queries of students more efficiently as comparison to teachers with low CK. Further it can also be said that teachers having high content knowledge have high level of positive attitude. This may be due to good content knowledge boosting their affective dimension in terms of their upbeat feeling, interest towards science. Proper content knowledge also inspiring them to be updated with new content by inferring journals, magazines and reference books related to scientific research and innovations. Enrichment in content also nourishing their positive attitude while teaching science. Similarly it is also evident that teachers performing skills of introduction, explanation, using teaching aids, evaluation excellently are with optimum level of knowledge in science. Teachers who controlled and manage science class more successfully are also having sound level of CK in terms of scientific concepts. Further teachers who have high level of PC in science could solve questions based on application and skill objectives.

Thus probable cause for this type of positive correlation between CK and PC of a science teacher can be summarised as (i) Good CK is helping a teacher to design adequate pedagogical strategies inside classroom.(ii) CK has supplementary role in expression of PC on the part of a teacher.(iii) CK assist a teacher in planning , selecting, adopting and executing relevant method of teaching science (iv) Good CK motivates a teacher to acquire latest scientific knowledge (v) In addition to this proper level of CK helps a teacher to structure the lesson in a systematic and logical way.(vi) CK supports a teacher to do content analysis of a particular science topic and use inductive and deductive logic which is necessary to frame a relevant lesson plan.(vi) Content knowledge is necessary for formulating general and specific objectives of teaching science.vii) CK is also influencing science teachers' decision taking power with respect to choosing method of teaching, teaching aids, experiments and activities, designing learning experience, clearance of doubts, instructional strategies, formulation of questions base on knowledge, understanding,

application and skill. (viii) CK adds a teacher with good explanation skill while constructing knowledge of the child from concrete to abstract. (ix) CK has an important role to relate scientific concepts, laws and principles with that of the day to day real life situation. It enriches teacher's competency with respect to correlating bookish science related concepts with that of real life situation by giving relevant example and illustration. They could analyze and synthesize appropriately while explaining scientific facts. (x) CK in science also influencing the competency of a teacher to use scientific approach to teach in classroom

Challenges to Science Teacher Education and Conclusion

The role of content knowledge and pedagogical competency in effective science teaching is crucial. It is found that content knowledge of science teacher is related with their pedagogical competency positively with respect to their sex, age, qualification and teaching experience. However it is found that content knowledge of science teacher is low (Panda,2012). Hence it becomes a great challenge for the teacher education system to enrich the content knowledge of science teacher both at pre service and in service teacher education. Strategies such as seminar, conference, workshop, co curricular activities, orientation course, refresher course, Continuous and comprehensive evaluation of science teachers' content knowledge and pedagogical competency, Guest lecture/demonstration must be adopted to nurture the content knowledge of science teacher. Thus for inculcating appropriate pedagogical competency of science teacher in pre service as well in service teacher education there should be provision of nurturing content knowledge in science.

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