CHAPTER - V

SUMMARY, CONCLUSIONS AND DISCUSSION
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AND SUGGESTIONS

Science teachers need to acquaint themselves with latest developments and equip themselves with new skills so as to impart them to their students. They should inculcate creativity, scientific attitude and attitude towards science among students who will help the nation in meeting survive the global challenges.

Creativity is everywhere. The creative talent does not limit itself to the literary boundaries but goes much beyond it. It is in the art forms, it is in pedagogy, and it is in management too.

Scientific attitude is a cognitive concept and is a composite of a number of mental habits or tendencies to react consistently in certain ways to a novel or problematic situation. These habits or tendencies include accuracy, intellectual honesty, open-mindedness, suspended judgment, criticalness, and habit of looking for true cause and effect relationships. These habits are important for everyone in everyday life. Scientific attitude possesses attributes thought to be either true or false and do not express an evaluative quality. The attributes of scientific attitude are rationality, curiosity, open mindedness, aversion to superstitions, objectivity in intellectual honesty and suspended judgment.
Attitude is an emotional reaction towards a person or thing. It is a personal response to an object, developed through experience, which can be characterized as favourable or unfavourable. The use of science as the object or stimulus of the feelings delineates a set of attitudes known as ‘attitudes towards science’. It was hoped that increasing interest in science would result in increased science enrolment which in turn would yield a larger science workforce pool and a science literate public.

Effective science teaching practice is still not a regular occurrence in many classrooms around the world. Science teachers significantly differ in their functioning and their objectives. The abilities of the teachers will play an important role in performing their duties but not many studies are available in this applied field. The research in the context of science education is not popular among the scholars. There are so many areas in the field of science education, but, so far, researchers mostly focused on teacher-centric themes.

Hence, there is a felt need to study creativity, scientific attitude and attitude towards science of prospective science teachers. There are only handful of studies to discern the relationship of locality, sex, medium of instruction, educational qualifications, academic achievement and annual income of the family and their impact on the level of creativity, scientific attitude and attitude towards science of prospective science teachers. This has prompted the researcher to undertake the present study.

The present research work was intended to measure the creativity, scientific attitude and attitude towards science of prospective science teachers,
and the association among creativity, scientific attitude and attitude towards science. The variables considered for the present study were rural and urban, male and female, graduate and post graduate, Telugu medium and English medium, academic achievement, and annual income of the family of prospective science teachers. The present study was confined to the Colleges of Education of Andhra Pradesh, India.

The objectives of the present study are: 1. To find out the creativity, scientific attitude and attitude towards science of prospective science teachers. 2. To find out the difference in the creativity, scientific attitude and attitude towards science of rural and urban prospective science teachers. 3. To find out the difference in the creativity, scientific attitude and attitude towards science of male and female prospective science teachers. 4. To find out the difference in the creativity, scientific attitude and attitude towards science of graduate and post-graduate prospective science teachers. 5. To find out the difference in the creativity, scientific attitude and attitude towards science of Telugu medium and English medium prospective science teachers. 6. To find out the difference in the creativity, scientific attitude and attitude towards science of high, average and low academic achieving prospective science teachers. 7. To find out the difference in the creativity, scientific attitude and attitude towards science of prospective science teachers of below poverty line and above poverty line families. 8. To find out the association among creativity, scientific attitude and attitude towards science of prospective science teachers. 9. To find out the association among creativity, scientific attitude and attitude towards
science of rural and urban prospective science teachers; male and female prospective science teachers; graduate and post-graduate prospective science teachers; Telugu medium and English medium prospective science teachers; high, average and low achieving prospective science teachers; and prospective science teachers belonging to below poverty line and above poverty line families.


For the present research, normative survey method was used in order to study the creativity, scientific attitude and attitude towards science of prospective science teachers.

The variables namely, urban prospective science teachers versus rural prospective science teachers, prospective male science teachers versus prospective female science teachers, graduate prospective science teachers versus post-graduate prospective science teachers, English medium prospective science teachers versus Telugu medium prospective science teachers, high, average and low achievement of prospective science teachers and family income of prospective science teachers were selected considering their role in determining the level of creativity, scientific attitude and attitude towards science.

The hypotheses were formulated taking the objectives into consideration. The hypotheses are formulated in Null form. They are: Hypothesis 1: Prospective science teachers are not possessing high creativity. Hypothesis 1a: There is no significant difference in the creativity of rural and urban prospective science teachers. Hypothesis 1b: There is no significant difference in the creativity of male and female prospective science teachers. Hypothesis 1c: There is no significant difference in the creativity of graduate and post-graduate prospective science teachers. Hypothesis 1d: There is no significant
difference in the creativity of Telugu medium and English medium prospective science teachers. Hypothesis 1e: There is no significant difference in the creativity of high, average and low achieving prospective science teachers. Hypothesis 1f: There is no significant difference in the creativity of prospective science teachers of below poverty line and above poverty line families. Hypothesis 2: The prospective science teachers are not possessing high scientific attitude. Hypothesis 2a: There is no significant difference in the scientific attitude of rural and urban prospective science teachers. Hypothesis 2b: There is no significant difference in the scientific attitude of male and female prospective science teachers. Hypothesis 2c: There is no significant difference in the scientific attitude of graduate and postgraduate prospective science teachers. Hypothesis 2d: There is no significant difference in the scientific attitude of Telugu medium and English medium prospective science teachers. Hypothesis 2e: There is no significant difference in the scientific attitude of high, average and low achieving prospective science teachers. Hypothesis 2f: There is no significant difference in the scientific attitude of prospective science teachers of below poverty line and above poverty line families. Hypothesis 3: Prospective science teachers are not possessing high attitude towards science. Hypothesis 3a: There is no significant difference in the attitude towards science of rural and urban prospective science teachers. Hypothesis 3b: There is no significant difference in the attitude towards science of male and female prospective science teachers. Hypothesis 3c: There is no significant difference in the attitude towards science of graduate and post-
graduate prospective science teachers. Hypothesis 3d: There is no significant
difference in the attitude towards science of Telugu medium and English
medium prospective science teachers. Hypothesis 3e: There is no significant
difference in the attitude towards science of high, average and low achieving
prospective science teachers. Hypothesis 3f: There is no significant
difference in the attitude towards science of prospective science teachers of below poverty
line and above poverty line families. Hypothesis 4: There is no significant
association among creativity, scientific attitude and attitude towards science of
prospective science teachers. Hypothesis 4a: There is no significant difference
in the association among creativity, scientific attitude and attitude towards
science of rural and urban prospective science teachers. Hypothesis 4b: There
is no significant difference in the association among creativity, scientific
attitude and attitude towards science of male and female prospective science
teachers. Hypothesis 4c: There is no significant difference in the association
among creativity, scientific attitude and attitude towards science of graduate
and post-graduate prospective science teachers. Hypothesis 4d: There is no
significant difference in the association among creativity, scientific attitude and attitude towards science of Telugu medium and English medium prospective
science teachers. Hypothesis 4e: There is no significant difference in the
association among creativity, scientific attitude and attitude towards science of
high, average and low achieving prospective science teachers. Hypothesis 4f:
There is no significant difference in the association among creativity, scientific
attitude and attitude towards science of prospective science teachers of below poverty line and above poverty line families.

Stratified sampling technique was used as it is the most appropriate technique for the present study. Out of 800 sampling units, 448 rural and 352 urban prospective science teachers; 372 male and 428 female prospective science teachers; 652 graduate and 148 post-graduate prospective science teachers; 584 Telugu medium and 216 English medium prospective science teachers; 240 high, 456 average and 104 low achieving prospective science teachers and 456 below poverty line and 344 above poverty line families prospective science teachers were included in this study.

As the present study was a comprehensive one, the available standardized tools were adopted to study creativity, scientific attitude and attitude towards science. Creativity Scale developed by Baqer Mehdi was used to study the creativity of prospective science teachers. Scientific Attitude Scale developed by J. K. Sood and R. P. Sandhya was used to study the scientific attitude of prospective science teachers. Attitude towards Science Scale developed by Avinash Garwal was used to study the attitude towards science of prospective science teachers.

For the data collection, the investigator personally visited the selected Colleges of Education and administered the tests after taking permission from the administration. Thus, the data was collected from the total sample, scoring was done and scores were assigned to each prospective science teacher.
The Statistical Techniques namely mean, standard deviation, critical ratio, F-test and chi-square test were used to analyze the raw scores and to extract the findings. Based on the findings, suitable conclusions were drawn for necessary discussion and implementation.

CONCLUSIONS AND DISCUSSION

Science education has become an integral part of human life, without which we cannot live effectively in this 21st century. Identifying the multifarious values of science education, it is included in the school curriculum as a compulsory subject. But the success of this course depends on the ability of the teacher. The abilities of the teacher will play a vital role.

The following are the conclusions drawn from the analysis of data.

1: The prospective science teachers hold average creativity.

Jain (1992) identified a positive and highly significant correlation between creativity and classroom creativity, teaching aptitude and teaching skills.

In a country of billion people, enough creative persons are available and a sizeable number amongst these would be school-going children. The paradox of the situation is that, in India, mostly, students are not given an opportunity of developing creative maturity throughout their entire school career (Aggarwal, 1999).

Since, today's students are tomorrow's teachers or scientists or other professionals; there is a need to give emphasis on the development of creativity at school level. For that, the teacher has to be equipped with
teaching ability to develop creativity. So the methods to develop creativity should be included in teacher education programmes for the prospective teachers.

2. The rural and urban prospective science teachers are with average creativity without any significant difference between them.


Rural-urban divide is narrowing in India. Majority of the Indians are residing in rural areas and the students are moving to urban localities for their education. This may be the probable reason for this result. At the same time, we are in the information technology era and now information is accessible to everybody everywhere. The introduction of AKASH Tablet PC may create more advanced facilities to the school going children.

The teachers have to realize the fact that the locality is not going to have any impact on the development of creativity. So, special focus should be given by the teachers to raise the creativity levels of students.

3. The male and female prospective science teachers are with average creativity with no significant difference between them.

(1989), Gautam (1992), Kumar (1992), Rodríguez and Grande, (2007) have also found no difference between men and women in their creativity. It may be due to the fact that the parents are with similar perceptions and expectations of their sons and daughters. The teachers should try to develop creativity among students without worrying about gender of the student.

4. The graduate prospective science teachers are with average creativity and post-graduate prospective science teachers with low creativity. There is a significant difference in the creativity of graduate and post-graduate prospective science teachers.

Comparatively more creative prospective science teachers are found in graduates than post-gradates. This is not a positive indication for the post-graduate education system.

There is a need to study the relationship between the learning conditions and creativity in our higher education system and try to increase the levels of creativity.

5. The Telugu medium and English medium prospective science teachers were with average creativity with no significant difference between them.

Language is a channel for communication and anybody can excel in any field by having good communication skills. Several academicians suggest that mother tongue is helpful in expressing or understanding any subject. As the present study didn’t find any influence of medium of
instruction or learning on the creativity levels of prospective science teachers. There should be enough scope for students enhance their creativity in educational institutions.

6. The high, average and low academic achieving prospective science teachers were with average creativity without any significant difference among them.


Creativity is the ability of thinking in a new dimension and the achievement is the ability to learn the subjects. If the achievement is not influencing creativity, then education has to focus on establishing the relationship between these two variables. The creativity of learner may be helpful in descriptive examination.

7. The prospective science teachers of below poverty line (BPL) and above poverty line (APL) families are with average creativity with a significant difference between them. The prospective science teachers from APL families are with more creativity then their counter parts.

Income level has a positive impact on the creative ability of the prospective science teachers. Comparatively, high income group has shown high level of creativity and low income group has shown low level of creativity.

Facilities that are with high income families have some influence on the creativity of the people. There is a need to create more public facilities to promote creativity among all the people. Educational institutions need to be equipped with modern facilities to decrease the differences between haves and have-nots in creativity levels of learners.

8. The prospective science teachers are holding average scientific attitude.

The present study revealed that there is a change in the status of scientific attitude in the past twenty years. In 1989, Bhaskara Rao reported that prospective science teachers were possessing low scientific attitude. The prospective science teachers moved from low level to average level of scientific attitude through all these years.

Students entering into the teacher education program are not clear in science concepts and in the conduct of simple science practicals. Majority of them reported that they were not exposed to practical aspects either in graduation or in higher secondary level in learning science. Either science
curriculum or the way of imparting that subject; and may be both are not
up to the mark and needs transformation to inculcate scientific attitude.

Now, we have to focus on the special activities to add in teacher
education program to develop scientific attitude in the prospective science
teachers.

9. There is no significant difference in the scientific attitude of rural
and urban prospective science teachers and both of them are with
average scientific attitude.

The urban colleges are equipped well with all the facilities;
technology is available and the quality of teaching may also be good as
many people say. The prospective science teachers might have completed
their school education in different localities, but college education might
be in urban or semi urban localities. This may be the reason for no
difference between them. There is a need to develop scientific attitude in
both the sub-groups by designing relevant activities to promote their
creativity.

10. There is no significant difference in the scientific attitude of male and
female prospective science teachers and both of them are with
average scientific attitude.

The results are in common agreement with Shinde (1982), Ghosh
(1989), Bhaskara Rao (1990) and Kumar (1991). This is a positive
indicator for the gender equality.
Gender is not influencing the scientific attitude. This study indicates that if conducive facilities are provided to women, they will equally as men. There is a need to focus on the improvement of scientific attitude among prospective science teachers.

11. **There is a significant difference in the scientific attitude of graduate and post-graduate prospective science teachers though both of them hold average scientific attitude. The graduate prospective science teachers are with high scientific attitude than post-graduate prospective science teachers.**

Graduate prospective science teachers demonstrated significantly better scientific attitude then the post-graduate prospective science teachers. This is also an unexpected result and there is a need to explore the reasons for this. We have to build a scientifically strong society to enter into the list of developed world by increasing the scientific attitude in prospective science teachers, who in turn help their students in schools.

12. **There is no significant difference in the scientific attitude of Telugu medium and English medium prospective science teachers and both of them are with average scientific attitude.**

This result revealed that medium has no influence on scientific attitude. This may be due to the use of rote memory to study science and teachers may also be using traditional methods to teach science subjects.
We have to create better facilities like good libraries, virtual laboratories and visits of scientists to the institutions for interaction with the teachers and students to develop scientific attitude.

13. **There is no significant difference in the scientific attitude of high, average and low academic achieving prospective science teachers and all of them are with average scientific attitude.**

    Shinde (1982) and Paulose (1995) found that students with high academic achievement had high scientific attitude, students with average academic achievement had average scientific attitude, and the low achievers had a low scientific attitude.

    We are not changing our education and evaluation patterns in our academic institutes to evaluate science. We are using the same method of evaluation to all the subjects but science subjects are different in nature. There is a need to examine the way of learning science and restructure the evaluation system to raise the standards of teaching science. By this the scientific attitude can be enhanced in the learners of science.

14. **There is no significant difference in the scientific attitude of prospective science teachers of below poverty line and above poverty line families and are with average scientific attitude.**

    Ghosh (1989) also confirmed the same result that income levels are not influencing the level of scientific attitude.

    There is a need to develop the scientific attitude in the total population. Income of a family should not become a hindrance in
having better scientific attitude. There is a need to keep activities in teaching methodology of science that develop scientific attitude.

15. The prospective science teachers are holding average attitude towards science.

It is happy to know that the prospective science teachers are having favorable attitude towards science subject. But majority of the prospective science teachers are holding average level of attitude towards science and it is not a positive indicator.

In majority of the cases, parents are taking decision to send their children to science stream. Even after fifteen years of study, the feeling about science, that it is a difficult subject, is not completely removed. It is treated as the source to get job and hence, the pursuers of science are not having high attitude towards science.

There is a need to organise workshops, seminars, conferences, etc., to improve the level of prospective science teacher's attitude towards science.

16. There is no significant difference in the attitude towards science of rural and urban prospective science teachers and both of them are with average attitude towards science.

Usually, urban prospective science teachers are supposed to posses a high attitude towards science subject as they have more chances of exposure to various types of scientific experiences and good infrastructural facilities. But this study states that the exposure to
scientific events and good institutional facilities have no bearing on the development of a favourable attitude towards science.

17. **There is no significant difference in the attitude towards science of male and female prospective science teachers and prospective science teachers are with average attitude towards science.**

Lightbody and Durndell (1966), Schibeci (1984), Simpson and Oliver (1985), Kar D.K (1990), Hykle (1993), Molly Weinburgh (1995), Maitra, Krishna and Alka (1997), Swiatek and Lupkowski (2000) found that boys were far more likely to report liking for science than girls.

Srivastava, Veena (1992), Siegle and Reis (1994) found that the girls had more favorable attitude towards science than the boys.

Ghosh (1986), Malviya, Dharma Shila (1991) Prasanth (2004) also found that, while boys and girls did not differ on scientific attitude.

There is no significant difference between male and female prospective science teachers is a positive indication for the reduction of gender differences. The alarming concern is that 70% of the group is with average and low level of attitude towards science.

18. **There is a significant difference in the attitude towards science of graduate and post-graduate prospective science teachers. The graduate prospective science teachers are with high attitude towards science than their counter parts though both of them possess average attitude towards science.**
There is a need to explore the reason for this status and improve the present conditions because though the post-graduates get five years of science education, they are with low attitude towards science than their graduate counterparts who had three years of science education.

It becomes the responsibility of teacher education institutions to develop high attitude towards science in their student clientele.

19. There is no significant difference in the attitude towards science of Telugu medium and English medium prospective science teachers and both of them are with average attitude towards science.

This is a positive indication for the advocates of native language to be used in higher education also. There is a need to develop the facilities to promote quality in science instruction to develop high attitude towards science, without bothering about the medium of instruction at least at higher education stages.

20. There is no significant difference in the attitude towards science possessed by high, average and low academic achieving prospective science teachers and all of them are with average attitude towards science.

This is not a positive indication on the quality of our science education as majority of the prospective science teachers are performing academically with various levels are with only average attitude towards science. There is a need to examine the relevancy of the present position of the prospective science teachers in our science education system.
21. There is no significant difference in the level of attitude towards science prospective science teachers of below poverty line and above poverty line families and they are with average attitude towards science.

It is a good sign that the income of the family has no effect on the attitude of prospective science teachers towards science subject. If the teachers forget about their income levels and think that they are the teachers to build the progressive society, they will prepare the students with great eminence.

22. There is a significant association between scientific attitude and attitude towards science and there is no association between scientific attitude and creativity and attitude towards science and creativity of prospective science teachers.

The creativity of prospective science teachers has no association with either scientific attitude or attitude towards science. But, scientific attitude and attitude towards science are influencing each other. So, if we enhance the level of one of scientific attitude and attitude towards science, the other will be automatically improve itself.

23. There is a significant association between scientific attitude and attitude towards science in rural and urban prospective science teachers and there is no significant association between scientific attitude and creativity and attitude towards science and creativity in rural and urban prospective science teachers.
The relationship between scientific attitude and attitude towards science is conformed by this study in the context of localities. It is well established facts with ability in science will in developing a right attitude towards that subject. The astonishing result is that there is no significant relation between scientific attitude and creativity and attitude towards science and creativity. The result may be due to the varied reasons and needs explorations of causes to establish a relationship among these aspects.

24. **There is a significant association between scientific attitude and attitude towards science of male and female prospective science teachers and no significant association between scientific attitude and creativity and attitude towards science and creativity of male and female prospective science teachers.**

The relationship between scientific attitude and attitude towards science is conformed in the context of gender. The unpredicted results are that there is no significant relation among creativity, scientific attitude and attitude towards science. There should be pertinent efforts to establish an association among creativity, scientific attitude and attitude towards science in educational institutions.

25. **There is a significant association between scientific attitude and attitude towards science of graduate and post-graduate prospective science teachers and no significant association between scientific attitude and creativity and attitude towards science and creativity.**
creativity of graduate and post-graduate prospective science teachers.

The relationship between scientific attitude and attitude towards science is conformed in the context of educational qualification. The surprising result is that there is no significant relation among creativity, scientific attitude and attitude towards science. The result may be due to the heterogeneous nature of the graduates and post-graduates studying in teacher education institutes.

26. There is a significant association between scientific attitude and attitude towards science of Telugu medium and English medium prospective science teachers and no significant association between scientific attitude and creativity and attitude towards science and creativity of prospective science teachers.

The relationship between scientific attitude and attitude towards science is conformed in the context of medium of instruction also. The surprising result is that there is no significant relation among creativity, scientific attitude and attitude towards science. This indicates that medium of instruction has no bearing on the association among creativity, scientific attitude and attitude towards science.

27. There is a significant association between scientific attitude and attitude towards science of average and high achieving prospective science teachers and no significant association between scientific attitude and attitude towards science in low achieving prospective
science teachers. There is no significant association between scientific attitude and creativity and attitude towards science and creativity of low, average and high achieving prospective science teachers.

There is no significant relation among scientific attitude, attitude towards science and creativity in the context of academic achievement. The result may be due to the diverse nature of the academic achievement of the prospective science teachers.

28. There is a significant association between scientific attitude and attitude towards science of prospective science teachers of below poverty line and above poverty line families and there is no significant association between scientific attitude and creativity and attitude towards science and creativity of prospective science teachers belonging to above poverty line and below poverty line families.

The relationship between scientific attitude and attitude towards science is conformed in the context of income of the family of prospective science teachers. The surprising result is that there is no significant relation between scientific attitude and creativity and attitude towards science and creativity in the context of income of the students. The creativity, scientific attitude and attitude towards science of prospective science teachers need to be enhanced to prepare them as exemplary science teachers.
On the whole, creativity, scientific attitude and attitude towards science are average in the prospective science teachers. There is a highly significant and positive association among scientific attitude and attitude towards science. The teacher educators should try to promote the level of creativity, scientific attitude and attitude towards science among prospective science teachers to make them laudable science teachers.

SUGGESTIONS FOR FURTHER RESEARCH

In the light of the present study, the following studies may be taken up by the researchers.

- Comprehensive studies may be taken up covering the entire sample of the nation to find out the level of creativity, scientific attitude and attitude towards science and compare the level within the states.

- Studies may be taken up to identify the relationship among the creativity, scientific attitude and attitude towards science of the teachers working in schools and colleges.

- Studies may be taken up to compare the creativity, scientific attitude and attitude towards science of the teachers working in primary schools and secondary schools in order to fill the gap between these two levels.

- Studies may be taken up to identify the influence of intelligence, personality, aptitude, etc., on the level of creativity, scientific attitude and attitude towards science.

- Studies may be taken up to find out the effect of various psychological aspects on creativity, scientific attitude and attitude towards science.
• Studies may be taken up to study the influence of social adjustment of prospective science teachers on creativity, scientific attitude and attitude towards science.

• Studies may be taken up to identify the influence of societal factors on creativity, scientific attitude and attitude towards science.