CHAPTER V

MAJOR FINDINGS, DISCUSSION AND CONCLUSION

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5.0.0 INTRODUCTION

In this chapter, the researcher has summarized the findings of the study followed by discussion and conclusion. The researcher had extracted these major findings from the analysis and interpretation of the data given in chapter VI.

5.1.0 MAJOR FINDINGS

Following are the major findings of the present study.

- All Community Science Centres imparted non-formal science education to students, teachers and general public as per their objectives of functioning. The centres had achieved the objectives of science education with their available resources and knowledge.

- In all centres, there was dearth of science communicators to impart non-formal science education to students and public. The lack of staff at science centres hindered science popularization activities. The attrition rate among these science communicators was very high in these centres. The staff left the science centres as they switched to other job or had other personal priorities.

- The research found that teachers did not actively participate in science activities at science centres as they were more engaged in school and personal work. They did not give priority to learning at science centres. The principals also did not inspire teachers to visit science centres. The school principals and teachers only participate in the activities at science centres only when they were instructed by higher authorities to do so.

- All the Community Science Centres were found financially sound but the Community Science Centres under Gujarat Council on Science and Technology (GUJCOST) wanted more grant from Gujarat Government for organizing more science activities.

- All Community Science Centres mainly catered their services to local students and public. However, Community Science Centre at Dharampur imparted science education across Gujarat while Vikram Sarabhai Community Science Centre at Ahmedabad imparted science education activities across India. All nine Community Science Centres conducted outreach activities for science popularization and eradicating superstitions. However, Gujarat Science City at Ahmedabad had no outreach activities.

- It was easier and comfortable for the students, who were enrolled in science clubs, in smaller groups to ask questions related to science to staff or resource person of the centres in comparison to their classes in schools where individual students did not do this. The conduct of experiments in the science centres by students individually helped in boosting their confidence. The science clubs at Community Science Centres helped in expressing the students' thoughts and sharing them with others.

- All Community Science Centres had very less science experiments for students. Mostly these were restricted to magnetism, optics, temperature and pressure. No original experiments were conceptualized by science centres except Vikram Sarabhai Community Science Centre at Ahmedabad. The experiments were found copied from internet. In rainy season, the activities and events at centres, especially outreach activities, were cancelled due to heavy rain.

- All science centres were well versed in astronomy education activities which were beneficial to students and general public. The science centres provided knowledge on astronomy with credibility and helped in reducing exaggerations among people

about the celestial bodies like planets of solar system, moon and constellations. They helped in making understand public on difference between astronomy and astrology. They knew the handling of telescopes and binoculars and its maintenance as well as observation of celestial objects. The school teachers did not know all this nitty-gritty's of astronomy education. Hence the students, teachers and public were beneficial from the know-how of science centres. Moreover, the astronomical observation had to be done in late evening and night. The school teachers were engaged in their personal work and family commitments. They had no time for astronomy activities for students. Also, the schools could not run in evening or night, especially for astronomical observation. Thus, Community Science Centres were proved valuable in imparting astronomy education. The science centres were useful learning resources for students as in some schools the education materials, apparatus as well as chemical substances for doing scientific experiments were not available. Thus the centres filled the gap between learner and learning aids.

- The public and students watched the exhibits on astronomy and movie in planetarium because they felt exaggerated about sky, clouds, sun, moon, stars and universe. They had a specific visualization in mind about images of universe, solar system, planets, moon, sun and earth. They believed that the planets like Jupiter, Venus and Mars were gigantic in nature when seen from human eyes. Due to images communicated by media like documentaries on television, internet and print media, public felt these exaggerations. The images in media were manipulated in colour, shape and size with the help of computer software. The people, by consuming media, understood and perceived the image of celestial objects (planets of solar system and other formation in the universe) as seen in media. The astronomy programmes of science centres had succeeded in breaking this false belief of the public about universe. The images of celestial objects were seen very small from eyepiece of telescope in counter to images seen in multimedia. As the telescope showed the object as per the focal length of the lens, the gigantic image in minds of public broke down. Community Science Centres

had succeeded in interpolating the actual image seen through human eye and people had educated through astronomy events organized by science centres. The centres had succeeded in creating a realistic image of universe, planets of solar system and celestial bodies which had helped public and students to understand astronomy in a realistic manner.

- The research study showed that the students who came to participate in science club activities at Community Science Centres at Anand and Vadodara decreased drastically. So centres faced shortage of students. The resources of the centres meant for students like children books, magazines, chemicals used for performing experiments and kits were unutilized. The parents did not send their children to centres as parents gave priority to tuition classes. The students were well grossed in tuition so that they could not devote time to centre's activities.

- The pubic understand that science was a teaching subject rather than an important aspect to live life. They considered God was the creator of scientific concepts. Community Science Centres failed to explain that the concepts were a natural phenomenon and had nothing related to God.

- The parents enrolled their children in the science centres so that the children can be engaged in some activities for learning and during that time the parents can do their household. The research found that students enrolled at science centres did not attend activities at the science centres when they were in standard 10 and 12 as they were giving more priority to their board examinations. The students responded that during that time, they were engrossed in their own study and did not get time to visit the centres.

- The researcher founded that as Vikram Sarabhai Community Science Centre was oldest, reputed and resourceful. The culture of the centre was too formal and the centre tried to dominate the partner science centres or organizations with whom it worked for conducting science activities. In Bhavnagar also, there was murky competition between Vigyan Nagari and Regional Community Science Centre for conducting science activities.

- The infrastructural facilities at all nine centres were found remarkably well except Community Science Centre at Dang. The Community Science Centres which were set up independently had their own building facility while Community Science Centres at Vadodara worked in a building given by state government on lease. Also Community Science Centres in Dang and Amreli worked in a building given by state governments. The infrastructural facilities were very poor at Community Science Centre at Dang as it did not have their own water connection for washroom, poor potable drinking water facility and lacked cleanliness.

- The Director or Executive Director was the head of Community Science Centres. The post of director was full time, except in case of Community Science Centre at Anand where it was honorary. The staff worked full time or part time as per the need of the centres. The minimum qualification for head and staff were post graduate and graduate in science respectively. Mostly the staff handled all science activities at all nine centres except Vikram Sarabhai Community Science Centre at Ahmedabad. It had specific staff for specific activities at laboratories. i.e. the physics, chemistry and biology laboratories were handled by science educators who had degree in physics, chemistry and biology respectively. Different resource persons were called for specialized science and art activities at all nine centres. The students who had studied from Lokbharti Vidyapeeth worked as staff member of the Lokbharati Community Science Centre. The staff had a degree and diploma in rural development and education. The centre had in-house resource persons as Lokbharti Gram Vidyapeeth boasted of rural educational institutes, schools and development centres on agriculture, horticulture, education and animal husbandry. The centre used technological devices for science education. Mobile Technology for quiz, interactive exhibits and models on latest technology were utilized by them.

5.2.0 PROBLEMS FACED BY THE COMMUNITY SCIENCE CENTRES

The research found that all nine Community Science Centres faced the problem of human resources management. There was dearth of science educators and science communicators to work at science centres and to conduct non-formal science education activities. There was no staff available for conducting science experiments at centres, schools and to do the outreach programmes. There was a dearth of subject experts for conduction of activities such as robotics, art and craft and rocketry. The technical persons for maintenance and repair of working activities were also not easily available. There was a major problem of telescope repair because it had to send to other parts of India for repair. Thus there were difficulties during astronomical events.

Moreover, there were specific problems of different Community Science Centres. At Community Science Centre in Amreli, the children and public broke the exhibits at science park in a mischief. Hence the centre had to bear the cost to repair them. The centre sometimes faced voltage fluctuation problem. Hence, during astronomy education activities at planetarium, there was chaos and activity was not done properly. As there were no working models, the centre could not manage properly to make the students understand the science concepts to students, teachers and public.

Community Science Centre at Dang did not have its own vehicle. Hence, the staff went for outreach activities to far flung tribal areas of Dang on their own vehicle. The resource persons were not available for activities in Dang. The centre invited experts from other parts of Gujarat, mostly from Surat. The head and staff of the centre put lots of efforts to conduct science activities as tribal people were apathetic to learn science.

All nine centres did not face financial problems but Community Science Centre at Anand sometimes had financial problem as the grants from GUJCOST came late. Thus it faced difficulty in conducting programmes due to shortage of funds.

Community Science Centre at Dharampur faced the problem due to the interruption in the supply of electricity. Also, the centre did not get technical persons for the maintenance of the exhibits as it was located in taluka area.

5.3.0 DISCUSSION

Community Science Centres had contributed in imparting science education to students and public. Every science centres had its own identity, whether they were under Gujarat Council of Science and Technology (GUJCOST) or under State Government or Central Government or worked independently. Community Science Centres had created their distinctiveness by chalking down scientific activities and conducting science popularization events and programmes. Community Science Centres mainly catered to the needs of students. The activities, programmes and events of centres were organized keeping in mind the needs of the students. This was done as science centres considered that students were main target audience for them and were prospective science experts of the future. The conceptualization and operation of science activities were very unique which school teachers did not know. Astronomy was a subject which was given very much importance in all nine Community Science Centres. The results of this research study is in line with the studies done by Mathew (2008), Makwana (2008), Davidsson (2009), Falk and Needham (2010), Daneshamooz et al. (2013), Meshoulam and Feinstein (2013), Morentin and Guisasola (2013), Lelliott (2014), Senturk and Ozdemir (2014), Weiland (2014) and Falk et al. (2014).

The researcher observed that the public considered science as a 'teaching' subject and they had a view that science was helpful to students only. The parents did not relate science with their daily life but visited science for their children’s interest. The people considered only environment, plant and trees as science. The meaning of science for them was restricted only to science topics on computers, environment and space science. Also the meaning of astronomy was restricted to sky, sun and stars only. Community Science Centres had helped in making the meaning of science in a broad manner and understanding varied disciplines of science in a holistic manner. However, the researcher

observed that people were confused with the concept of science portrayed by exhibits at centres. They were not ready to understand the science conveyed to them as they were restricted to the meaning of science in a very narrow manner.

The research study showed that in schools, students did experiments in hurry. So they enrolled in science centres for performing experiments individually and peacefully. The special lectures of scientists and stalwarts at science centres helped students to get exposure of world of science. They got stimulus to search for scientific models on internet for construction of their knowledge.

The researcher concluded that Community Sciences were unable to explain to public that scientific principles were a part of nature and there was nothing related to God in natural phenomenon. The centres failed to justify scientific concepts to public.

5.4.0 CONCLUSION

All nine Community Science Centres of Gujarat were performing the functions of science popularization with the help of science activities, exhibits and models. The models, exhibits, science programmes and events were used as tools to impart science education in non-formal method. Those were considered as great means for experiential learning. The science centres had contributed immensely by conceptualizing and implementing science education programmes for students and community. However, the researcher felt that the hands-on experiments and activities for science popularization were very less and all nine Community Science Centres did not have strategy for future goals in science learning. There was no addition of updated exhibits keeping pace with advancement of science and technology. The activities and exhibits were decades old which had lost present relevance. The activities and exhibits on progression of science and technology in Artificial Intelligence, Virtual Reality and innovative technology were found missing in Community Science Centres.

Community Science Centres became complacent in their duty of science education by displaying exhibits, charts and models only. The centres and its staff were inactive in imparting science education to students and public by not giving interpretation of exhibits. They did not provide learning materials to students, teachers and public. There was scarcity of science educators and science communicators who could conceptualize and make learn science activities for students as well as community. The research also concluded that all nine science centres catered to students only. Major programmes and activities of the centres were made keeping students as the target audience. The public programmes had remained confined to specific events like World Environment Day, science exhibition, astronomy events and some outreach activities. The centres had not chalked out strategies on how to make science acceptable in public.

The research concluded that the schools did not have activities and programmes which were done by Community Science Centres. The schools did not have constituents of science education like planetarium, simulator rides and gigantic halls of science. These lacking and loophole in schools was advantageous for science centres. The students were attracted towards them to learn science with fun and entertainment and strengthen their understanding in science. However, the students who visited science centres were not serious in learning science and they created chaos, especially during the visit at centres.

All nine Community Science Centres need to boost their activities in science for students, teachers and public. They should keep pace with the growing science and technology with the help of their resources and expertise.