Research Article

Correlates of ICT Knowledge with Attitude towards Learning Chemistry among the Tenth Standard Students of Jawahar Navodaya Vidyalaya

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Abstract

The Information and Communication Technology (ICT) has emerged as a catalyst in educational system. ICT is touching every activity in our daily life. In order to make our students face the challenges of 21st century, we must integrate ICT in all teaching learning processes. Technology tools have to be creatively and effectively infused in the teaching learning processes to create an interactive and productive learning environment for the students. Foreseeing the importance of ICT in the process of educational transactions of students, Navodaya Vidyalaya Samiti (NVS) introduced computer-aided educational program with e-learning modules, internet and variety of educational software in all 576 Jawahar Navodaya Vidyalayas (JNV) across the country. NVS encourages all teachers to make use of the ICT materials, computer lab and smart room facilities to the maximum level to provide quality education to all students. Each teacher is motivated to develop their own e-lessons along with the readymade CDs commercially available for each subject. E-lessons/contents developed by the teachers are to be arranged topic-wise, class-wise and should be shared with other Vidyalayas through subject-wise blogs. In accordance with this demand, the investigator has prepared ICT-based learning package which consists of ten ICT-based e- lessons for tenth standard CBSE Chemistry (Science). 75 students of tenth standard JNV, Mysuru, were subjected for experimentation. Two months of intervention was given. Children learnt the concepts using ICT-mediated learning package. Pre-test and post-test were conducted for ICT knowledge and attitude towards learning chemistry. The results were analyzed using Pearson Chi-Square test. Results showed that there is a significant positive relationship between different levels of ICT knowledge and various levels of attitude towards learning chemistry.

Keywords: Attitude towards learning chemistry, ICT Knowledge, Chi-Square test, Jawahar Navodaya Vidyalaya.

Introduction

In today's world, Information and Communication Technology (ICT) has grown abundantly so that everyone of us should inevitably adapt it for our successful survival. Internet and computers have become an effective medium to establish communication between schools, teachers, students, parents and policy makers. Technological developments like PowerPoint presentations, 3D visualization tools, digital cameras, projectors and educational software package have become great resources for teachers to help students grasp a concept easily. It has to be understood that visual explanation of concepts makes learning fun and enjoyable for students. They are able to participate more in the classroom, and even teachers get a chance to make their classes more interactive and interesting. ICT greatly facilitates the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance their educational systems to improve policy formulation and execution. The importance of technology in schools can be understood from the fact that it empowers the educational system and produces better students.

ICT Knowledge

ICT is making dynamic changes in society. Its influences are felt more and more at schools because ICT provides both students and teachers with more opportunities in adapting learning and teaching to individual needs. Society is forcing schools aptly respond to this technical innovation. ICT has revolutionized the way people work today and are now transforming education systems. As a result, if schools train children in yesterday's skills and technologies they may not be effective and fit in tomorrow's world.

This is a sufficient reason for ICT to win global recognition and attention. Tinio (2002) states that the potential of ICT is in increasing access and improving relevance and quality of education in developing countries. The 2005 Education for All (EFA) Global Monitoring Report highlights the importance of high-quality education as follows: *The achievement of universal participation in education will be fundamentally dependent upon the quality of education available. (UNESCO, EFA Global Monitoring Report 2005, p.28).*

Students' Attitude towards Learning Chemistry

Chemistry is an important branch of science which enables students to understand what happens in the world they live in and how it contributes to the quality of life on our planet (Ware, 2001). Chemistry curricula commonly incorporate many abstract concepts, which are central to further learning in both chemistry and other sciences (Taber, 2002). Attitude towards chemistry is essential; it denotes interest or feelings towards studying chemistry. Attitude and academic achievement are important outcomes of science education in secondary schools.

Attitude represents student's behavior or mental tendencies to react consistently in certain ways to resolve the challenging issues. It is normally associated with the habit of looking for true cause-and-effect relationship. According to Rao (1989), the most useful scientific attitudes are open mindedness, suspended judgment, intellectual honesty, willingness to change opinion, search for truth, curiosity, rational thinking, etc. Students' attitude and interest could play substantial role in student's decision to study science (Abulude, 2009). Recent publications present a gloomy picture regarding students' ignorance in chemistry, and decline in enrolment in science-based careers (Hofstein & Naaman, 2011). Small percentage of students (about 4%) expressed the wish to study chemistry at the university level (Salta, 2004).

Jawahar Navodaya Vidyalaya

Jawahar Navodaya Vidyalaya is a unique co-educational residential school providing modern, quality, free education to gifted students, especially from rural areas, to compete with their urban counterparts on an equal footing. In order to give individual attention to maximum number of students and to inculcate discipline to follow daily routine and rules, uniform life style, the concept of "Residential Schools" is established. The government has recognized this concept and to create egalitarian society with special emphasis on development of rural children it launched "*Jawahar Navodaya Vidyalaya*" scheme. Under this scheme, high-quality education will be given to rural children and their inherent and latent talent will be identified in a systematic manner. Such children are provided an opportunity and nurtured progressively till they become fit to take up challenges of the modern society.

Significance of the Study

The factors that could positively influence students' attitude towards learning chemistry could be teaching approaches and educational tools. Hence, for enhancing attitudes towards learning chemistry, the method which is used to present the content and instructional techniques play an important role. The central role of teachers in any education system emphasizes that the quality of education is directly linked to how well teachers are prepared for teaching. In today's world, teachers need to be equipped not only with subject-specific expertise and effective teaching methodologies, but also with the capacity to assist students to meet the demands of the emerging knowledge-based society. Teachers therefore require familiarity with new forms of ICT and need to have the ability to use that technology to enhance the quality of teaching and learning.

Navodaya Vidyalaya Samiti (NVS) encourages all teachers to make use of the ICT materials, computer lab and smart room facilities to the maximum level to provide quality-education to all students. Each teacher is motivated to develop their own e-lessons along with the readymade CDs commercially available for each subject. E-lessons/contents developed by the teachers are to be arranged topic-wise, class-wise and should be shared with other Vidyalayas through subject-wise blogs. To meet this demand, the investigator has prepared ten ICT based E- lessons for two chapters. Two months of intervention was given. Children learnt the concepts using ICT-mediated learning package. Pre-test and post-test was given for ICT knowledge and attitude towards learning chemistry. Hence the investigator

wants to find out any change in students' attitude towards learning chemistry and ICT knowledge due to this ICT-mediated teaching and learning.

Objectives of the Study

The study was conducted with the following objectives:

1. To find the correlation of different levels of ICT knowledge with the different levels of students' attitude towards learning chemistry.
2. To find the association of different levels of ICT knowledge with respect to the sub variables like gender, locale and migration status.
3. To find the association of different levels of ICT knowledge with respect to student's father's educational qualification and occupation.
4. To find the association of different levels of attitude towards learning chemistry with respect to the sub variables like gender, locale and migration status.
5. To find the association of different levels of attitude towards learning chemistry with respect to student's father's educational qualification and occupation.

Hypotheses of the Study

H1: There is no significant relationship between different levels of ICT knowledge and different levels of students' attitude towards learning chemistry.

H2: There is no significant association between different levels of ICT knowledge and sub variables like gender, locale and migration status.

H3: There is no significant association between different levels of ICT knowledge and student's father's educational qualification and occupation.

H4: There is no significant association between different levels of attitude towards learning chemistry and sub variables like gender, locale and migration status.

H5: There is no significant association between different levels of attitude towards learning chemistry and student's father's educational qualification and occupation.

Sample for the Study

This is an experimental study. 75 students, who were studying in 10^{th} standard in Jawahar Navodaya Vidyalaya, Mysore, were subjected for experimentation. The investigator prepared computer-based learning package which consists of ten e-lessons. Five e-lessons from 10^{th} standard chemistry first Chapter: Chemical reactions and equations and another five lessons from second chapter: Acids, bases and salts. Each lesson had seven subdivisions. These included PowerPoint presentations, video showing teacher explanation along with PPT, video showing Lab activity, video showing Playway method of learning, PPT for relevant self-test quizzes, PPT showing important points to remember and other relevant downloaded videos. After explaining the topics in the smart lab, children were given chance to watch those packages themselves and allowed them to learn at their own pace.

Tools Used for the Study

Following tools were used in this study:

The tool "ICT knowledge scale" was developed and standardized by Dr. S. Angel Rathnabai and Dr. G. Viswanathappa (2014). It was adopted to measure the level of knowledge about basic computer operations, software applications, internet resources and basic ICT peripheral. Totally 35 items were selected. Among these, 9 items were selected for basic computer operations, 10 items for software applications, 12 items for internet resources and 4 items for basic ICT peripheral. The 5-point rating score was followed. A score of 0-for not aware of the components, 1-for aware of the components, 2-for familiar with the use of components, 3-for knowledgeable about the components and 4-for highly knowledgeable about the components were followed.

The tool "The attitude towards learning chemistry" was developed and standardized by Dr. A. Gracy and Dr. R. Krishnaraj (2012). It was adopted to measure the student's attitude towards learning chemistry using computer-based learning package. Totally 32 items were selected. The 5-point Likert rating score was followed. A score of 1 is assigned to 'Strongly disagree' response, 2 for 'Disagree' response, 3 for 'neutral' response, 4 for agree response and 5 for 'strongly agree' response were followed.

Analysis of Data

All the above hypotheses were verified by using Chi-Square test under cross tabulation of SPSS package.

H1: There is no significant relationship between different levels of ICT knowledge and various levels of attitude towards learning chemistry.

The summary of the Chi-Square test results is shown in Table 1.

Table 1.Correlates of ICT Knowledge Scale with Attitude towards Learning Chemistry Cross-Tabulation

Descriptive Variable			Attitude towards learning Chemistry			Chi-Square value	P-Value
			Low	Average	High		
ICT knowledge scale	Low	Count	5	2	0	18.741	.001
		% within ICT knowledge scale	71.4	28.6	0.0		
	Average	Count	8	42	6		
		% within ICT knowledge scale	14.3	75.0	10.7		
	High	Count	0	9	3		
		% within ICT knowledge scale	0.0	75.0	25.0		

From the Chi-square and p values, it was found that there is positive relationship between levels of ICT knowledge and the levels of attitude towards learning chemistry.

$X^2(4, N=75)=18.741$, $p=.001$. Since P value is less than 0.01, the above hypothesis is rejected at 0.01 level of significance. So the alternate hypothesis stated that there is a significant relationship between different levels of ICT knowledge and various levels of attitude towards learning chemistry.

H2: There is no significant association between different levels of ICT knowledge and sub-variables like gender, locale and migration status.

Table 2.Chi-square Table showing Association between Gender, Locale, and Migration Status with Levels of ICT Knowledge Scale

S. No.	Sub-variables			ICT Knowledge Scale			Chi-Square Value	P-Value
				Low	Average	High		
1	Gender	Boys	Count	3	28	7	0.463	0.793
			%	7.9	73.7	18.4		
		Girls	Count	4	28	5		
			%	10.8	75.7	13.5		
2	Locale	Rural	Count	4	44	9	1.574	0.455
			%	7.0	77.2	15.8		
		Urban	Count	3	12	3		
			%	16.7	66.7	16.7		
3	Migration status	Non-migrated	Count	6	41	9	0.515	0.773
			%	10.7	73.2	16.1		
		Migrated	Count	1	15	3		
			%	5.3	78.9	15.8		

From the Chi-square and P values, it was found that there is no association between levels of ICT knowledge and the sub-variables like gender, locale and migration status. The values reported for the sub-variables gender, locale and migration status are $X^2(2, N=75)=0.463$, $p=.793$: $X^2(2, N=75)=1.574$, $p=.455$: $X^2(2, N=75)=0.515$, $p=.773$ respectively. In all the above cases, the P values are greater than 0.05, so the above null hypothesis is accepted at 0.05 level of significance.

H3: There is no significant association between different levels of ICT knowledge and student's father's educational qualification and occupation.

Table 3.Chi-square Table showing Association between Different Levels of ICT Knowledge and Student's Father's Educational Qualification and Occupation

S. No.	Sub-variables			ICT Knowledge Scale			Chi-Square Value	P-Value
				Low	Average	High		
1	Father's educational qualifications	PUC and below	Count	4	28	6	0.524	0.971
			%	10.5	73.7	15.8		
		Graduate	Count	2	23	5		
			%	6.7	76.7	16.7		
		Post-graduate	Count	1	5	1		
			%	14.3	71.4	14.3		
2	Father's occupation	Govt. employee	Count	3	24	3	3.323	0.505
			%	10.0	80.0	10.0		
		Private employee	Count	0	8	1		
			%	0.0	88.9	11.1		
		Agriculture	Count	4	24	8		
			%	11.1	66.7	22.2		

From the Chi-square and P values, it was found that there is no association between levels of ICT knowledge and the sub-variables like father's educational qualification and father's occupation. The values reported for the sub-variables father's educational qualification:father's occupation are $X^2(4, N=75)=0.524$, $p=0.971$: $X^2(4, N=75)=3.323$, $p=.505$ respectively. In all the above cases, the P values are greater than 0.05, so the above null hypothesis is accepted at 0.05 level of significance.

H4: There is no significant association between different levels of attitude towards learning chemistry and sub variables like gender, locale and migration status.

Table 4.Chi-square Table showing Association between Different Levels of Attitude towards Learning Chemistry and Sub-variables Like Gender, Locale and Migration Status

S. No.	Sub-variables			Attitude towards learning Chemistry			Chi-square value	P value
				Low	Average	High		
1	Gender	Boys	Count	6	27	5	0.194	0.908
			%	15.8	71.1	13.2		
		Girls	Count	7	26	4		
			%	17.3	70.7	12.0		
2	Locality	Rural	Count	8	42	7	1.812	0.404
			%	14.0	73.7	12.3		
		Urban	Count	5	11	2		
			%	27.8	61.1	11.1		
3	Migration status	Non-migrated	Count	11	39	6	1.018	0.601
			%	19.6	69.6	10.1		
		Migrated	Count	2	14	3		
			%	10.5	73.7	15.8		

From the Chi-square and P values, it was found that there is no association between levels of attitude towards learning chemistry and sub-variables like gender, locale and migration status. The values reported for the sub-variables gender: locale: migration status are:

$X^2(2, N=75)=0.194$, $p=.908$: $X^2(2, N=75)=1.812$, $p=.404$: X^2 $(2, N=75)=0.1.018$, $p=.601$ respectively. In all the above cases, the P values are greater than 0.05, so the above null hypothesis is accepted at 0.05 level of significance.

H5: There is no significant association between different levels of attitude towards learning chemistry and student's father's educational qualification and occupation.

Table 5.Chi-square Table showing Association between Different Levels of Attitude towards Learning Chemistry and Student's Father's Educational Qualification and Occupation

S. No.	Sub-variables			Attitude towards learning Chemistry			Chi-Square value	P-Value
				Low	Average	High		
1	Father's educational qualification	PUC and below	Count	8	25	5	1.927	0.749
			%	21.1	65.8	13.2		
		Graduate	Count	4	22	4		
			%	13.3	73.3	13.3		
		Post-graduate	Count	1	6	0		
			%	14.3	86.7	0.0		
2	Father's occupation	Govt. employee	Count	5	23	2	2.194	0.700
			%	16.7	76.7	6.7		
		Private employee	Count	2	5	2		
			%	22.2	55.6	22.2		
		Agriculture	Count	6	25	5		
			%	17.3	69.4	13.9		

From the Chi-square and P values, it was found that there is no association between levels of attitude towards learning chemistry and sub-variables like father's educational qualification and father's occupation. The values reported for the sub variables father's educational qualification:

Father's occupation are $X^2(4, N=75)=1.927$, $p=0.749$: $X^2(4, N=75)=2.194$, $p=.700$ respectively. In all the above cases, the P values are greater than 0.05, so the above null hypothesis is accepted at 0.05 level of significance.

Interpretation and Discussion of Results

1. The findings of the present study reveal that the students who were subjected to learn chemistry using computer-based learning package have developed higher level of ICT knowledge and also the attitude towards learning chemistry. This means that there is a positive relation between ICT knowledge and attitude towards learning chemistry. The relationship can be strengthened further if more number of computer systems are made available for free access to students. Since our school is a residential set-up, children are not allowed to keep any electronic systems in the dormitories. So computer laboratories should be kept open for long evening hours to ensure maximum number of students should get a chance of seeing the package again and again and develop their ICT knowledge and positive attitude towards learning chemistry.
2. Values from Tables 2 and 4 reveal that boys are showing little marginal higher ICT knowledge as well as attitude towards learning chemistry than girls. This shows that naturally boys get little more attraction and curiosity towards technology than girls. The boys get fascinated and interested towards exploring new things. Boys have the confidence to apply what they learn in real-life situations. It is an inborn trait of boys.
3. It was inferred from the values of Tables 2 and 4 that rural children are showing little marginal higher ICT knowledge as well as attitude towards learning chemistry than urban children. This may be due to the fact that urban children are getting easily distracted due to media and other activities than rural children.
4. One of the important features of the Navodaya Vidyalaya Scheme is the scheme of exchange of students from one Navodaya Vidyalaya in a particular linguistic region to another Vidyalaya in a different linguistic region to promote understanding of the diversity and plurality of India's culture and people. According to the scheme, 30% of children from one Navodaya Vidyalaya are migrated to another Vidyalaya at Class-IX level. The migration takes place generally between Hindi and non-Hindi-speaking districts. From JNV, Mysuru, around 19 students migrated to JNV, Kousambi, UP state. When they came back, they were also subjected to ICT-mediated learning approach along with the non-migrated students. It is clearly shown from the results that ICT knowledge of non-migrated children is higher than migrated children and also attitude towards leaning chemistry of migrated children is better than non-migrated children. This may be due to change of location, change of teacher approaches and change of culture.

Educational Implications and Recommendations

- Computer-based learning package (CBLP) is found to be effective in developing attitude towards learning chemistry and ICT knowledge among 10th standard students of Jawahar Navodaya Vidyalaya, Mysuru. The learners are able to attain mastery of the subject due to the flexibility of the process at the level of learning. The package provides them ample freedom to learn chemistry subject at their own speed and ability reduces stress and anxiety. The package creates interest and motivation by avoiding monotony in the class. Taking into consideration the benefits of technology-supported package, there is a need for such package materials for the benefit of secondary and higher secondary learners. It is therefore recommended that there be a greater application of technology packages at all levels of education so as to enable learners to achieve mastery over the subjects according to their own pace and ability. The NVS should provide continuous professional development activities for teachers on the preparation and use of e-content.
- The NVS may think about creating open educational resources (OER) on the lines of National Repository for Open Educational Resources (NROER) and Karnataka Open Educational Resources (KOER).
- Recently, CBSE has suggested all its affiliated schools to train their teachers on online labs (Olabs) to facilitate them in the enrichment of teaching and learning process. Now time has come for all the subjects and creative teachers to understand and apply technology in the teaching-learning process. A need arises for the production of such technology-supported courseware materials, modules and packages to encourage fast learning and to create a conducive learning environment within the portals of education. In this respect, it is more appropriate for both the states and the center to come out with a technology policy to impart training in the development and application of technology-supported modules and packages.

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