EFFECTIVENESS OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) ON TEACHING OF LIFE SCIENCE AT HIGHER EDUCATION

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ABSTRUCT:-

With increased through, and ever increasing numbers of students aspiring for higher education, concerns of equity in education and issues of quality have also begun to attract attention. The challenge of developing alternate modes of education, continuing education, teacher capacity building, and information systems for efficient management of the higher education system are being addressed. With Information and Communication technologies becoming more accessible, reliable and mature, the prospect of leveraging ICT for education is becoming increasingly feasible. ICT enabled teaching-learning encompasses a variety of techniques, tools, content and resources aimed at improving the quality and efficiency of the teaching- learning process. Ranging from projecting media to support a lesson, to multimedia self-learning modules, to simulations to virtual learning environments, there are a variety of options available to the teacher to utilize various ICT tools for effective pedagogy. Each such device or strategy also involves changes in the classroom environment, and its bearing on effectiveness. ICT is very effective Tools for proper understanding of the subject content. It gives more opportunity to the student to modify their concept through ICT use in classroom. Availability of a wide range of such teaching-learning materials will catalyses transformation of classrooms into ICT Enabled classrooms. The provision of quality education is the fundamental right of all the students in India.

KEY WORDS: Effectiveness, Information and communication technology (ICT),Achievement, Intelligence, Intelligence test.

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INTRODUCTION

Education is equally important as food, cloth and shelter. Without which man will be restricted to water tight compartment of ignorance. In fact, education opens the window for the human beings towards a beautiful world where a polished existence is ensured. The fact changing face of the world too needs human beings to update him/her and rise up to the need of the hour to equip him/her as par with the counterpart in the other part of the world.

In the era of science and technology and its impact on the higher educational system is immense. The aim of education is not only to impart the latest knowledge and skill to the individual but also speed up the progress, so that student can cope up well the the advancing society. Such situation necessitates, teacher to take optimum support of information and communication technology to facilitate him/her learner in the process of knowledge construction and speed up the progress. Therefore it is felt that education of any country must take the help of the modern technology to improve its quality as well as the quantity. In fact, to make education more meaningful and comprehensive for the individual learner, the information and communication technology is playing an important role.

Following sustained initiatives spread over many decades, the country can today boast of perhaps one of the largest ever higher education systems. With increased through, and ever increasing numbers of students aspiring for higher education, concerns of equity in education and issues of quality have also begun to attract attention. The challenge of developing alternate modes of education, continuing education, teacher capacity building, and information systems for efficient management of the higher education system are being addressed. With Information and Communication technologies becoming more accessible, reliable and mature, the prospect of leveraging ICT for education is becoming increasingly feasible. ICT enabled teaching-learning encompasses a variety of techniques, tools, content and resources aimed at improving the quality and efficiency of the teaching- learning process. Ranging from projecting media to support a lesson, to multimedia self-learning modules, to simulations to virtual learning environments, there are a variety of options available to the teacher to utilize various ICT tools for effective pedagogy. Each such device or strategy also involves changes in the classroom environment, and its bearing on effectiveness. Availability of a wide range of such teaching-learning materials will

catalyses transformation of classrooms into ICT Enabled classrooms. The provision of quality education is the fundamental right of all the students in India. With the help of ICT integrated education the student's performance is enhanced. The students perform better by the teaching of ICT. Due to this importance of ICT the investigator wanted to take up the study entitled" Effectiveness of ICT on teaching of Life Science at higher education stage". Investigator decided to study the effectiveness of ICT on the achievement and teaching of Life science. The findings of the study may be useful for educationalist, planners, physiological and economic significant.

Life science is the subject which deals with the very day to day experience of the human being. For the acquiring of knowledge in the field of Life science we need to generate a lot of interest amongst the students.

Information and communication technology seems to have all the potentialities to enhance the interest, understanding and achievement of the students. Chaudhury (1996) pointed out that ICT may help teacher to transact the lesion effectively and also help the teachers to present variety of related materials. Transaction of the lesson with the help of ICT will lead to interest and develop understanding among the students, which will lead to the enhancement in achievement.

As we know that life science is both the theoretical as well as practical subject. Its content consist of both theory and experiments, it requires the assistance of new software for the detail study of various concept.

PURPOSE OF THE STUDY

The study sought to investigate the effectiveness of information and communication technology (ICT) on teaching of Life science at Higher education.

OBJECTIVES OF THE STUDY

The study was conducted with the following objectives:

- To study the effect of ICT-used teaching on the students' achievement in Life science.
- To study the effect of traditional teaching on the students' achievement in Life science.
- To study the comparative effect of ICT-used teaching and traditional teaching on the students' achievement in Life science.

HYPOTHESES:

Keeping in mind the need, aim, and objectives of the problem in mind the following hypotheses wee formulated to facilitate study.

- **H1-** There exist significant difference between the mean achievement scores of experimental group and control group.

- **H0**- There exist no significance difference between the achievements.

RESEARCH METHODOLOGY:

Methods to conduct a research study differ in their nature and intent. Choice of the methods of research is determined by the nature of the problem. The present study is an attempt to study the effect of ICT on the students' academic achievements. It is obvious that the effect of ICT cannot be studied through survey or historical method. It needs an experimental setting. Keeping this in mind, the investigator used pre-test, post-test experimental method to conduct this study.

A design is used to structure the research, to show how all the major parts of the research projects the sample or groups, measures, treatments or programmes and method of assignments work together to try to address the central research question. Winer (1971) compared the design of an experiment to an architect's plan for the structure of a building. The designer of experiments performs a role similar to that of the architect. The prospective owner of a building gives his basic requirements to the architect, who then exercising his ingenuity prepares a plan or a blueprint outlining the final shape of the structure. Similarly, the designer of the experiment has to do the planning of the experiment so that the experiment on completion fulfils the objectives of research. In the present study, students in the ICT group were taught using a power point programme saved to CD-ROM. The power point presentation included animated pictures, video clips. Students in the traditional group were taught using a chalkboard, textbooks, models and charts. Experimental classes housed a ceiling-mounted LCD projector that was connected to a computer and classroom projector projected onto an interactive whiteboard. The power point

presentation was presented on a ceiling- mounted LCD projector. The presentation expanded each lesson by providing extra examples and examples from the homework. Students were able to solve example problems and then instantly see the answer on a large screen in the classroom. This presented them immediate feedback. In the present study, pre-test post-test control group quasi experimental, design was employed with a purposive sample in the form of intact sections of B.Sc (2 year) in Life Science of the same college. The study included a control group (30 students) and an experimental group (30 students). The experimental group was taught through ICT used teaching and the control group through traditional method. The intact sections were equated on intelligence and socio-economic status. A figurative representation of the design is given below.

DESIGN OF THE STUDY

Group	Pre-test	Independent variable	Post-test
Experimental	X1	ICT use	X2
Control	X1	Traditional teaching	X2

The study involved three operational stages as identification stage, treatment stage and post-testing stage. The first stage involved pre-testing of all the students of both groups on intelligence achievement and in Life Science. The second stage involved the experimental treatment, which consisted of ten subunits of B.Sc (2 year) grade Life science taught through ICT used teaching and through traditional teaching to control group. The third stage dealt with post testing of the control and experimental group using the achievement test in Life science. A schematic view of the phases of experiment is presented in following Table.

PHASES OF THE STUDY

STAGE	CONTROL GROUP	EXPERIMENTAL GROUP
1. PRE-TEST	Measurement of achievement in Life science.	Measurement of achievement in Life science.
2. TREATMENT	Teaching Life science with conventional method.	Teaching Life science through the ICT used method.
3. POST-TEST	Measurement of achievement in Life science.	Measurement of achievement in Life science.

The term 'Population' is used in research to describe any group of individuals, events or observations in which the researcher is interested. In the present study, the term population refers to B.Sc (2 year) in Life science students studying in Gour Banga University College.

Sampling makes it possible to draw valid generalisation by studying a relatively small proportion of the population selected for observation and analysis. In the present investigation, Utter Dinajpur of West bengal was the field of study. The sample of the study comprised 30 pupils each studying in two sections of the B.Sc (2 Year) in life science of Gour Banga University college. One section formed the control group and the other section formed the experimental group, as shown in Table.

SAMLE OF STUDY

S. No.	Groups	Total no. of Students
1	Experimental group	30
2	Control group	30
	Total	60

The sample is small for the result of the study to be generalized; an experimental study is normally more suitable on a small sample, as is evident from earlier investigations conducted through experimental design, which used small samples only.

PROCEDURE FOLLOWED

Procedure of the experiment comprised of two main stages, that is, selection of the sample and conducting the experiment.

Stage1: Selection of the sample The sample of the study comprised of 60 students of B.Sc (2 year) in Life science (30 as control group and 30 as experimental group) studying in Gour Banga University College,,uttar Dinajpur. **Selection of Experimental Group**: For the experimental group, a total of 30 learners studying in B.Sc (2 year) standard,

Selection of Control Group: The control group consisted of 30 learners studying in B.Sc (2 year) standard.The group was exposed to traditional method of instruction. No novel treatment was given to the control group of students.

Stage2: Conducting the experiment

The experiment was conducted in three phases:

Phase I: Administration of the Pre-test. Before the start of the experiment, the sample subjects were contacted and rapport was established with them. They were oriented about the tests to be used. The pre-tests i.e. Achievement Test was administered to the students of two groups by the researcher herself. The instructions pertaining to the tests were explained verbally in clear terms to the students before administering the test. The administration of the tests was carried out as per norms and instructions contained in respective test manuals.

After this, the students of both the groups were provided orientation and instructions about the treatment to be allotted to them to get over the anxiety and curiosity of the students. The students of the experimental group were given a trial of their respective materials, which helped them in getting over the curiosity and anxiety around via the electronic system being applied in the classroom setting. The students of the control group were also made familiar about the objectives, etc, of the tests to elicit their cooperation in the conduct of the study.

Phase II: Conducting the Instructional programme The second phase of the experiment was addressed to the real execution of the experiment. In this phase, the experimental group students were taught by ICT-used teaching and the control group students were taught by traditional method of teaching. The instructional treatment was given about 8 days to the experimental group, where as the control group was taught by the traditional method. Same content was taught to both the groups.

Phase III: Administration of Post-test. Immediately after the instructional treatment was over; the researcher tested the subjects of experimental group and control group on the dependent variables.

PRE-TEST OF BOTH THE GROUP

Differences of intelligence test scores between control and experimental group:

S. No	Level	N	Mean	SD	t-Value	df	Level of Significance
1	Control	30	30.966	6.06	0.742	58	Not significant
2	Experimental	30	30.466	5.68			

The mean difference between the two groups is not significant

The two groups are almost exactly similar. It may be seen from the table that two groups did differ on the one variables of intelligence. Hence they were treated as matched group for conducting the experiment. One group was randomly made experimental group and another group as control group. The experimental group was subject to the experimental treatment, teaching through information and communication technology (ICT). The control group was subjected to traditional teachings.

PRECAUTIONS OBSERVED

Following precautions were observed during the course of experiment (Pre-test –treatment-Post-test) for ensuring effectiveness and high precision in experimental condition which may have contributed to the results.

- No undue stress or control of any kind was imposed on the subjects at any time during the study and the experiment was conducted in a relaxed natural sitting.
- Both the experimental and control groups were taught by the investigator herself to avoid any variation.

- The effectiveness of the experimental treatment was ensured by establishing rapport with students and teachers, maintaining natural setting, harmonious atmosphere, providing sufficient time for various activities in the experimentation and the like.
- It was ensured that the topics on contents of treatment had not been previously taught to the students in both the experimental and the control groups.
- Care was taken to keep importance of content matter during the course of treatment and it was not underplayed while fitting into the instructional treatment.
- Teaching periods of 35 minutes duration was utilized fully for treatment and time was not wasted during experimentation.

DEVELOPMENT OF POWER POINT PROGRAMME

Power Point is one of the most powerful tools in disseminating information and to learn everything from the basic to the more advanced features of a topic for the students. Using power point in the classroom helps students learn best visually, more elaborately and intelligently. It also makes the lectures interesting and joyful as well as a kind of fun, which results, in making the learning more memorable (Lepper and Hoddel, 1989). The dictum a picture is worth a thousand words befits the power point presentation as it presents and enriches the learning content as well as facilitates the teaching learning process, making it more or less graphical and pictorial to quicken the learners grasp and response . From the students' perspective class materials becomes a more legible and intelligible than hastily scribbled notes on overhead projector or chalkboard writing. Slide presentations are highly effective for enhancing classroom instruction, aiding students' productivity in laboratory settings. Students' response turns overwhelmingly positive; Electronic presentations help clarify, visualize, organize and summarize information (Lepper and Hoddel, 1989). The strength, merit and potential of that characterise power point programme make teaching and learning healthy, motivating and lasting.

Power point programme involves various phases

1.Concept Phase

Beginning with a clear concept lays foundation for an effective Power Point programme. Hence, it is essential to be very clear about the concept to be taught and for developing and effective Power Point teaching programme.

2.Plan Approach Phase:

The concept phase is crucial. It affects design and production as well as the overall shape of the proposed Power Point teaching programme. It also affects inclusion or exclusion and choice of texts and graphics appropriated to the focus of the programme and it, enrichment for classroom instruction.

3.Design Phase:

Design is a complex area in the development of Power Point. It is often recommended to keep the design simple and adhere to its usability guidelines, whenever possible, that is the design elements must be consistently comprehensible to support user intuitiveness. Design features should adhere to usability standards.

4. Production phase

The production period is dependent on the concept and design processes; being harmonized through agreement in appropriate resourcing, scoping and development time, workflow issues, projected deliverables and outcomes in the light of objectives desired at the concept stage. It also includes mapping of milestones and minute monitoring activities, as well as a post-production period to gauge overall development for quality assurance, testing, and evaluation.

RESULTS:

In order to find out the relative effectiveness of ICT-used method and Traditional method of teaching, the scores of pupils on criterion measures were obtained before commencement of the experiment and after the treatment .Pre-test scores were also obtained on achievement Status of the sample students that were to be used as co-variants. This way pre-test scores were obtained on achievement in geography in answering the test questions in geography for the groups, i.e., the experimental group and the control group, whereas the post-test scores were obtained on achievement in achievement in answering the test questions in geography for the same groups.

EFFECT OF ICT- USED TEACHING METHOD ON STUDENTS' ACHIEVEMENT IN LIFE SCIENCE

This section deals with the effect of ICT-used teaching method of teaching on students' achievement. For this purpose, two groups were formed, i.e., the group of students taught through ICT-used teaching method formed the experimental group and the group taught by traditional method formed the control group. In the scheme of this study, students' achievement in Life Science being the first outcome variable, its focus was on three objectives:

(1) To compare the mean achievement scores of two groups of pupils taught Life science with and without the use of ICT- used teaching before the experimental treatment.

(2) To compare the mean achievement scores of two groups of pupils taught Life science with and without ICT -used teaching after the experimental treatment.

(3) To compare the mean gain achievement scores of two groups of pupils taught Life science with and without the ICT- used teaching after the experimental treatment.

MEAN AND MEAN GAIN ACHIEVEMENT SCORES OF B.SC (2 YEAR) LIFE SCIENCE STUDENTS

S.No.		Mean		Mean gain
	Group	Pre-test(1)	Post-test(2)	(2-1)
1.	Experimental group	30.46	42.43	11.97
2.	Control group	30.96	36.70	5.74

The pre- and post- test scores of experimental group and control group were obtained through an Achievement Test and were analyzed and described by using descriptive and inferential statistics. The data were analyzed for the total Achievement scores for both the groups. The Mean of Pre- test and Post- test scores were computed and are presented in Table 5.2.The data presented in Table 5.2 shows positive mean gain achievement scores for the experimental group. It is inferred that for the experimental group the mean post- test score is higher than the mean pre-test score with a very high significant difference. Hence, it is inferred that the ICT- used teaching method proved useful in increasing the knowledge and achievement level of B.Sc (2 year) students. So, the finding points to one and only one direction that ICT-used teaching method is effective for teaching of Life Science.

MEAN, STANDARD DEVIATION AND" t "VALUE OF PRE- TESTMEAN ACHIEVEMENT SCORES OF EXPERIMENTAL GROUP AND CONTROL GROUP

S. No	Level	N	Mean	SD	t-Value	df	Level of Significance
1	Control	30	30.966	6.06	0.742	58	Not significant (NS)
2	Experimental	30	30.466	5.68			

(NS) Not significant at 0.01 level

From Table, it is evident that there is no significant difference between the pre- tests means scores of the Control group and Experimental group. Therefore; two groups are similar in terms of their pre-test performance before the application of the treatment. Hence, the Control group and Experimental group in the present study were matched before the Experimental treatment as shown in Table though, the control group had a slightly higher mean score (30.966) in the pre-test than the experimental group (30.466).

MEAN, STANDARD DEVIATION AND" t "VALUE OF POST- TESTMEAN ACHIEVEMENT SCORES OF EXPERIMENTAL GROUP AND CONTROL GROUP

S. No	Level	N	Mean	SD	t-Value	df	Level of Significance
1	Control	30	36.7	4.120	4.120	58	Significant
2	Experimental	30	44.23	5.92			

Significant at 0.01 level.

The results in Table show that the mean score obtained by the experimental group is much higher (44.23) than that obtained by the control group (36.7) in the Post-test. Hence, students of experimental group showed a tremendous improvement in the post test scores after the intervention. Further, when the significance of the mean difference between the two groups was tested, t-value thus, computed was 4.120 which are more than the Table value of at 0.01level, indicating a significant difference between the mean post-test scores of experimental and control groups.

MEAN, STANDARD DEVIATION AND" t "VALUE OF PRE- TEST AND POST-TEST ACHIEVEMENT SCORES OF EXPERIMENTAL GROUP

Group	neasurement	N	Mean	S.D.	t –test
Experimental	Post-test	60	44.23	5.92	7.270**
	Pre-test	60	30.46	5.685	

****Significant at 0.01 level.**

The results in Table show that the mean post-test score obtained by the experimental group (44.233) is higher than the pre-test scores (30.466) . Further, when the significance difference between the mean pre-test scores and the post-test scores of experimental group's students was tested, t-value thus computed was 7.270 which is more than the Table value at 0.01 level, indicating a significant difference between the mean pre-test scores and the post-test scores of experimental group students related to their academic achievement.

MEAN, STANDARD DEVIATION AND" t "VALUE OF PRE- TEST AND POST-TEST ACHIEVEMENT SCORES OF CONTROL GROUP

Group	Measurement	N	Mean	S.D.	t -test
Control	Post-test	60	36.7	4.123	6.771**
	Pre-test	60	30.96	6.06	

****Significant at 0.01 level.**

The results in Table show that the mean post-test score obtained by the control group (36.7) is higher than the pre-test score(30.96) . Further, when the significance of difference between the mean pre-test score and the post-test score of control group's students was tested ,t-value, thus, computed was 6.771 which is more than the Table value at 0.01 level, indicating a significant difference between the mean pre-test scores and the post-test score of control group students related to their academic achievement If this difference and deviation in values are taken into consideration, this difference is in favour of the post-test. According to this, it is seen that there is an increase in the post-test score of students in control group who used the traditional education methods. But this increase is significantly lower than the increase rate in the post-test score of the students in experiment group as shown inTable.

On the basis of results obtained from the analysis of the data, hypothesis H1 and H0 of the study stands retained; that is,

- **H1-** There exists significant difference between the mean achievement scores of experimental group and control group.

- **H0**- There exists no significance difference between the achievement.

MEAN, STANDARD DEVIATION AND" t "VALUE OF POST- TEST MEAN GAIN ACHIEVEMENT SCORES OF EXPERIMENTAL GROUP AND CONTROL GROUP

Group	N	Mean	S.D.	t-value
1. **Experimental**	60	44.23	5.92	4.381**
	6o	36.7	4.12	
2. **Control**				

****Significant at 0.01 level.**

Table reveals that the experimental group achieved higher mean gain score than the control group on achievement test. It is evident that t- value 10.473 for the difference in the mean gain score of achievement of students of experimental group and control group is significant at 0.01 level . Thus, the subjects exposed to ICT-used method of teaching achieved significantly higher in comparison to those taught in the traditional method of teaching. It can be concluded that ICT used method of teaching is more effective than the traditional method in raising the achievement in Life Science in Higher college education.

FINDINGS OF THE STUDY

(1) The results arrived during this study show that the post-test achievement means scores of experimental group and control group's shows differences. This implies that the students who were taught using ICT method of teaching show significant improvement in their achievement in Life Science than the students who received instruction through the traditional method. It suggests that ICT used teaching method contributes towards raising the achievement of students in Life Science.

(2) A significant difference has been observed between the mean achievement pre- test scores and the post- test scores of control group related to their academic achievement.

(3) A significant difference has been observed between the mean achievement of pre- test scores and the post- test scores of experiment group related to their academic achievement.

(4) The group of students taught through ICT-used method show significantly higher means gain in achievement than the group of students taught through traditional.

CONCLUSION

The study provides potential inputs for Higher education. Given the current widespread use of ICT at all levels and for all subjects, it is imperative that pre-service teachers should learn the new technology. Besides pre-service training of teachers in the making, in-service training may also be given to the existing teachers to refurbish their acumen for teaching that is teaching effectively and meaningfully.ICT is very effective Tools for proper understanding of the subject content. It gives more opportunity to the student to modify their concept through ICT use in classroom. Availability of a wide range of such teaching-learning materials will catalyses transformation of classrooms into ICT Enabled classrooms. The provision of quality education is the fundamental right of all the students in India.

RECOMMENDATIONS :

- The study could be replicated to explore how ICT affects the students of various abilities on cognitive, emotional and motivational dimensions.
- There are need to compare ICT-used teaching method with other methods of instructions at different grade levels.
- The study could be replicated on a large sample for validation and for a longer duration to examine the effects on non-cognitive variable like social skills or some personality variables which take more time to bring about a change.
- There are need to study the integrated effect of ICT-used method with other institutional treatments.
- Research is needed to study the effect of ICT on special groups of children Such as gifted.

The learning disabled and other mildly handicapped students. Power point programme can be developed for other classes and research may be conducted to study the impact of power point programme on students' learning in various subjects/levels, i.e.; for subjects other than Life Science and for various levels as well, as also to determine the extent to which it could be used within the existing conditions and parameters in schools and other Higher educational institutions.

REFERENCES

Ainsworth, S.E., Bobby, P.A.and Wood, D.J. (1997) 'Information Technology and Multiple Representations: New Opportunities –New Problems,' Journal of Informational Technology for Teacher Education, 6pp93-106.

Allan H.K. Yuen, Nancy Law and K.C. Wong (2003). "ICT Implementation And School Leadership: Case Studies Of ICT Integration In Teaching And Learning,"Journal of Educational Administration, 41(2),2003,pp. 161.

Alexander, M.P. (1993). The effective use of computers and graphing calculators in college algebra. Dissertation Abstracts International, 54/06-A (Order No. AAD93-28010).

Apperson, J.M., Laws, E.L., & Scepansky, J.A. (2006). The impact of presentation graphics on students' experience in the classroom. Computers & Education, 47, 116-126.

Bain, A., Houghton, S., Sah, F.B., and Carroll, A. (1992, Summer). An evaluation of the application of interactive video for teaching problem-solving to early adolescents. Journal of Computer-Based Instruction,19 (3), 92-99.

Bauer, J., & Kenton, J. (2005). Technology integration in the schools: Why it isn't happening .Journal of Technology & Teacher Education, 13, 519-526.

Becker, H. (2000). Findings from the Teaching, learning and computing survey: Is Larry Cuban right? Report from a National Study. Irvine, CA: Center for Research on Information Technology and Organizations. http://www.crito.uci.edu/tlc/.

Betts, S., (2003). Does the use of ICT affect quality in learning science at Key Stage3? Studies in Teaching and Learning, pp. 9-17.

Bhat, V.D. (1982). A Study of the Effect of Simulation on Performance of Teacher Trainees in Educational Psychology, Ph.D. Edu., MSU.

Birmingham, P. (2001 Journal of Information Technology for Teacher Education, 10 (3), pp. 241- 252.

Bull, Glen; Bull, Gina; Kajder, Sara, 2003, "Writing with Weblogs: Reinventing student journals," Learning & Leading with Technology. ISTE (International Society for Technology in Education) Vol. 31(1).

Dawes,l.,Mercer,N.and Wegerif,R.(2000)Extending talking and reading skills using ICT. In Leak and Meadows (Eds.), J.Teaching and Learning with ICT in the primary school. London: Rout ledge

Gilmore, A. M. (1995). Turning teachers on to computers: evaluation of a teacher development program. Journal of Research on Computing in Education, 27(3), pp. 251–269.

Goodison, T. A.(2002). Learning with ICT at primary level: Pupils' perceptions. Journal of Computer Assisted Learning, 18 (3), 282-295.

Karchmer, R., 2001. The journey ahead: thirteen teachers report how the internet influences literacy and literacy instruction in their K-12 classrooms. Reading Research Quarterly, 36 (4), pp. 442-466.

Keller, F.S. (1968). Good-bye teacher. Journal of Applied Behavior Analysis, 1(1), 79-89.