# Information And Communication Technology To Aid Constructivism As Means Alternative Delivery In Nigeria

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## Abstract

*A national initiative recently launched saw the Nigerian Educational Sector orient towards integration of ICT into the learning process both as a subject and as a tool for diseminating other subject. As Nigeria aspires for technological growth, positive changesand priority must be assured towards educational values. Past educational theories seem not to cope with the information, ever-changing society. The need therefore arises, to develop alternative strategies that will help address its issues as well as develop new educational theories to bridge the gap. The long theory of constructivism will help tteachers to realize how important it is for them to prepare students for challenges ahead. This study thus, presents constructivist theories with a view of ICT integration into education as an alternative delivery in the Nigerian Educational System. It highlights requirements necessary for such integration ranging from technical (media literacy) to claimed deeper understanding of informatics – stressing importance of ICT as an effective means of improving education if properly harnessed as it equips teachers for the task ahead. It also tries to bridge ICT and constructivism, highlighting the educational processes required by teacher and students to succeed in such new learning environment. Thus, such power shift in educational paradigm and structures will equip students to become knowledge producer, help teachers to emancipate students academically, in a framework that measures quality of engaged student's learning.*

**Keywords:** Constructivism, Rationale, informatics, productivity, meida literacy, lifelong.

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## Introduction

"I***n the distant future, our children's grandchildren will develop a new equivalent of our classrooms... and spend hours in front of boxes with fires glowing, which will posses the wisdom to know the difference between light and knowledge..***" Plato (Discourse on learning).

The development of ICT has been closely featured a corresponding development of its technical support equipment – bringing about rapid development to our society. Today's dynamic society is a result of the information quest and anxiety and these changes remain the vital contribution of information, which aids effective decision making as well as improves our societal status. Today, we deal with information as they are applied to our everyday life and the field of "***Informatics***" – deals with the various aspects of data collection,

manipulation, storage and transfer from one system to another in multimedia form (via communications technology) and how it relates to people. We note that informatics is inseparably connected with computers – since computers are devices that have great capabilities for information transformation by the action of instructions and programs being performed on these data items to form information [1].

The last twenty years has witnessed an active era in the field of computer science (education) in the form of Web-Based Education. From our pedagogical practice, technical achievements common to us in our everyday life gets into the school environment very slowly. Nowadays, in most schools – we meet with passive and consuming approaches to availing ourselves of the educational opportunities made available by information and communication technology (ICT). Examples of these are the use of radios or watching videos both by the teachers and students in schools during the process of learning and teaching – bearing in mind that they can switch off their attention at any point in time [2-3]. The education sector is best viewed as dynamic that stems from a revolution triggered by modern technology for education delivery. These as used today in schools, continue to affect teaching/learning as well as presents to teachers and students, a plethora of tools that has greatly and will continue raise the educational standards, if properly applied. For an effective integration of such technologies into education, the enthusiasm of those taking part and good technical settings is not just sufficient enough anymore. Good knowledge, computer literacy, awareness campaign and staff development becomes a necessity that must be embraced for in-service and pre-service teachers. These programmes must show how to integrate ICT in education, as well teach them how to educate themselves (the teachers) and their students. Globally, ICT has shown significant positive impact on our way of life that enables governments all over the globe to make use of it and harness the features made available by it. [4-5] notes that ICT is becoming a way of life in globally (and Nigeria is not left out) – as national policies are in place that will contribute and stimulate the growth of ICT integration in our educational sector. [6] notes that if adhered, ICT will accomplish these:

a. Present teachers with a reachout means to more students than traditional face-to-face.
b. Provide students a chance to demonstrate their capability and self-innovativeness
c. Change the orientation and traditional approach of teaching to allowing the students to be in control of their learning process
d. Reduce teacher "wear and tear" as they deliver their lectures without being there in person
e. Make learning more convenient for the students as it alleviates those rigidity that has to do with the traditional approach of learning

The use of ICT does not really pose as a solution to every problem presented by educational delivery. It brings its tows, accompanied also by its own complexities that can impair delivery if not properly utilized. In much the same way, ICT will greatly improve the efficiency of an educational system, if it is properly harnessed. ICT methods of education represents any approach to instruction and teaching, which differs from the traditional approach that allows instructions to be received by a group of students and mostly delivered by a teacher via the use of expository methods. Over time, the development of ICT has caused a corresponding development in the educational sectors with the use of audio/video media, computer aided instruction/learning (CAL), fax technology amongst many others [6-7].

These are integrated in to simplify learning as educational concept shifts from teacher-centered to a state where student becomes self-motivated, self-paced studying and constructive. Early attempts at integrating new technologies into the educational sector (Nigeria in focus), was largely unsuccessful as judged from students' success and completion of course or study area and topics [8].

[8-9] as cited in [10] laments that science, technology, engineering and mathematics (STEM) is not given serious attention, as it is often misunderstood by Nigerian educators. Thus, proper values must be placed on the need for STEM to help us attain the much ***desired*** technological growth. We must shun the misconception that STEM education (technical related-subjects) are for those who cannot pursue academic programmes – and be aware that today's great industrialized nations employed both the services of ***educated*** and ***less*** educated in technological growth. Technological advancement in Nigeria today, is a sad reflection of the quality of STEM education that still receives stigmatization in our education system, and hinders the expected technological progress.

**Brief History Of Ict In Education**

[11-12] highlights ICT integration globally as thus:

**The 1960s/1970s**

a. First attempt to use computers in education were done with mainframes.
b. Machine oriented approach and electronic data processing as most of these computers were used in mathematical and engineering computations
c. Selected group of specialist in mathematics, engineering and its related fields, paid attention to developing programs to aid their fields.
d. Computer science/studies and its appreciation, taught only in technical universities
e. Pedagogical education influenced by cybernetics and manifested in an effort to automate the educational process. This gave rise to programmed instruction known as Computer aided instruction (CAI) and teaching machines. The basis of this development was the creating a complete guide of the student's work, which contain complete steps to certain subjects, check questions and reactions by the machine and informs the student about the correct answer.
f. Efforts to bring computers closer to people led to the idea that all should learn programming languages as mainframes and micros are used in schools.
g. Teaching of algorithms and programming languages in secondary schools now introduced in terms and how it applies to mathematics or other specialized subjects of programming
h. It was discovered that teaching programming, as a method of computer instruction and use were not suitable as teaching programming was taught in an effort to provide the students with larger freedom at work. This thus increased their motivation to learn but the whole process was still controlled by a program.

**The 1980s/1990s**

a. Computers spread amongst broad mass of users especially due to the large usage of software tools such as general-purpose software and package in the accomplishment of different tasks.
b. Personal computers introduced with revolutionary change of the human-computer interface to make computers more user-friendly.
c. Knowledge that computers were useful even to ordinary people led to the spread of computers even in schools at all levels.
d. Advent of computer aided instruction in learning so that such programs were written to be as intelligent as possible with the ability to react to students' responses. New teaching instructions based on

artificial intelligence arose with advent of MYCIN, EMYCIN, HACKER etc.

e. Teachers' specialization and knowledge in information machine deepens.
f. More effective and user-friendly systems emerge as a result of good programming.
g. These computer have been interconnected via the use of LAN/WAN to be able to share resources both locally and globally via networks.
h. General purpose applications get better giving rise to the application of multimedia techniques.
i. Schools now not the only place where learning can take place as teachers can meet (publicly and privately) to share ideas and information.
j. Hypertext becomes important to education programs and its construction arranged in such a way that only basic data is found at the first level and their details placed deeper in the structure.
k. Teacher preparation consists of computer skills and drills incorporated into their lessons.

**The Millenium 2000s**

a. Use of modern ICT equipments.
b. Global networks influences our way of life and work as ICT becomes the primary economy on which people will live.
c. Education's lifelong feat substantially increases.
d. Schools via teacher must engage students toward transformation with ICT integration into school teaching plans, a socio-economic development.
e. Co-operation of schools among each other and their support from industry, foundations and financial institution, as well as the government will find the necessity of realizing the task with the connection and introduction of ICT into teaching plans of schools.

Thus, the Nigerian Educational sector must not be left behind as it recently launched a national initiative termed "Computer for all Nigerian initiative (CANi) – alongside efforts made to incorporate ICT into the school's teaching plan. Information value and its amount increases rapidly and the use of ICT, multiplies better learning possibilities. Even before the invention and discovery of computers, one major objective of the educational sector was to prepare students to live and adapt in an information society.

Teaching cannot consist only in the transmission of knowledge and skills, since its basic advantage diminishes when such ***quick*** changing information is acquired and stored over time. Hence, for proper development of students so that they will be able to adapt to this information society, ICT integration will change and re-orient our traditional pedagogical approach of learning, from teacher-centered to student-initiated and motivated activities. It therefore becomes necessary to prepare the student's mind for creative work with the computer as a media for data and information representation. Today's evolution of science in education provides us with a series of concepts regarding the design and implementation of new learning environment that are conceived and created from new effective ways to education [13].

**Alternative Delivery: Overview**

The pprovision of modern technological equipment at all school levels varies due to the different levels of preparedness – both of teachers and students. A look at students' ability in obtaining the necessary flexibility in the world of information closely correlates amongst others, with the level of information setting of schools. This will help provide schools with information sources in printed and electronic format, regular updates as well as computer networks that will provide access to varied expanse of data as directed by experts in

the field of informatics. [14] notes that schools are grouped under the following:

1. Traditionsl Model consists of teachers, students and processes within an organized environment as in figure 1. Teachers teach varied courses and students learn as they attend/alternate the courses via face-to-face, oral method using pedagogical tools. Traditional schools use this pattern as a means of delivering education; The only-visible difference between schools is in their relationship, emphasis and appearance, which differs at various kinds of schools. The learning process depends largely on the teaching means and facilities – as some process involves experiments that make it more accessible. Contents of the experiment quicken learning under condusive facility or environment. Thus, improves students' understanding of knowledge received.

2. Information Education/Alternative Delivery: We have a limited conception of what ICT is capable of achieving in the Nigerian educational sector – because, school educational programs, curricula, standards and experts in the informatics trade are yet to be given the oppurtunity to express these feats as proper values must be placed on the need for info in our Educational System. It must be stressed/weighed on the scale of social knowledge. This has been totally ignored and omitted in the teaching plan of most institutions. Thus, people are less aware of what value information holds as well as that which they are dealing with. Data (information) remains the only and final article for transformation in this century. Teaching has therefore ended up in a vicious circle due to a narrow conception of information science as applied to the problems connected with knowledge of handling computer techniques.

As schools begin to lose their ability to stress on education of balanced and versatile-developed personality, the skills to handle data becomes the only criterion for a person's quality in an information age. Some issues must be addressed with full ICT integration in the Nigerian education sector as the means of knowledge transmission is changed from direct listening to audio sounds; and from looking at images to network transmitted digital signals in multimedia format using hypertext and information technology.

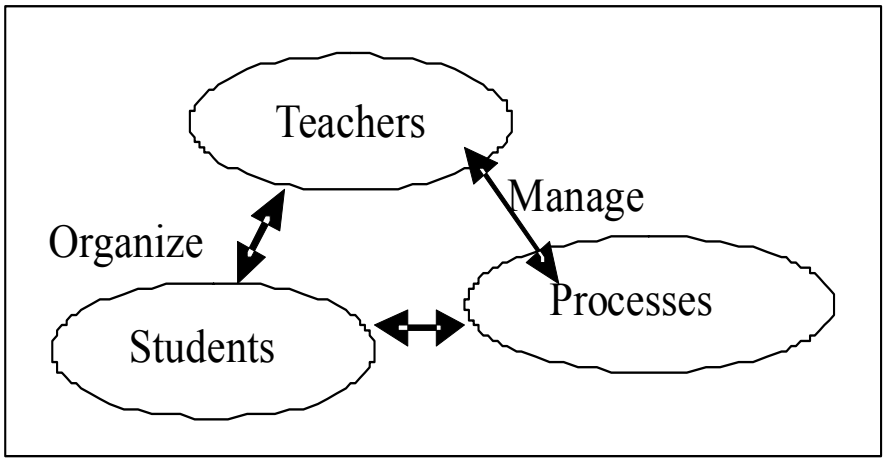


**Figure 1 represents a school model**

**Table 1: shows differences in the school systems**

| School Systems with Tools and Time | | | | |
|---|---|---|---|---|
| **School systems** | **Study place** | **Teaching Material** | **Teaching Tool** | **Study Time** |
| Traditional | Schools and classroom | Books | Chalks, Black-Boards and other physical devices | Phases |
| Informat-ion/Alte-rnative Delivery | Classroom Workspace and Homes | Electronic Books, CAI and CAL | Projectors Computer, whiteboards and networks | Lifelong learning via multi-Media format |

## ICT Integration Framework

ICT integration will results in great reforms to the learning process, and educators who advocate such reforms, opines that such learning be informed by constructivism [15]. Its reforms pleads the need for students to develop high thinking skill and the failure of the current schooling approachs/methods to provide such opportunities [16-17]. Thus, a critical factor to ICT integration is ***constructivism***, a concept that learning takes place as the learner completes tasks for which support is initially required; and results in media/computer-based learning, in which computers are used to maintain the learning environment and support the learner [18]. Technology creates an ideal learning, which [19] notes is been ignored or implementation has failed widely, in the past – because it creates a learner-centered, learning environment with a belief that they learn more from what they do/think rather the teacher's input. But we must take care not to allow the dynamic nature of technology overshadow the enduring nature of learning and/or the ever-increasing knowledge base about learning [17, 6].

Dewey [20] notes the concept of ***constructivism*** as one in which a learner has the ability to actively construct knowledge as he learns. It also emphasizes knowledge as a construction of reality in the learner's mind because knowledge is a dynamic adaptation towards an interpretation of experience. It supports many interpretations to reality based on knowledge constructed from experience and media-rich class. It focuses on knowledge ***construction*** rather than ***consumption*** – as the learner constructs data from experiences and mental beliefs, interpreting events accomplished outside the mind. We thus see the world we describe rather than describing the world we see. When integrated across curriculum, it provides appropriate level of difficulty due to its tasks that are of real world relevance with engaged-learning and teachers becoming knowledge guides [21] as seen in figure 2 below.

## Constructivism

**Constructivism** connotes the idea that learning is learner-centered and the learner has the ability to construct knowledge actively as he learns instead of passively assimilated. It emphasizes knowledge as a construction of reality in the learner's mind because knowledge is a dynamic adaptation towards an interpretation of

experience. [20] views constructivist learning as a one that supports varied interpretations to reality based on knowledge constructed from an experience and context-rich class. Thus, it focuses on knowledge ***construction*** rather than ***consumption*** – as the learner constructs data from mental beliefs and experiences, interpreting events accomplished outside the mind. Thus, we do not describe the world we see; but we see the world we describe.

The constructivist environment has tasks of real world relevance, integrated across curriculum to provide appropriate level of difficulty and learner involvement because its instructions are anchored on a real, world context. The learner's ideas and interest drives his ability in the learning process with teachers being flexible as knowledge guides and giver [21]. The setting is made up of socially mediated activities anchored on a learning environment where knowledge is generated based on learner's ability to construct knowledge from his environment. [22] notes that the four constructivist dimensions as ***trivial***, ***radical***, ***social*** and ***cultural***. Thus, principles of constructivist learning include:

1. Learning is ***active*** and consists of meaning construction and constructing system for meanings.
2. Knowledge construction is ***mental*** – since it happens in the mind of the learner.
3. ***Language*** influences greatly what we learn.
4. Learning is a social activity associated with connections the learner makes with others.
5. Learning is ***contextual*** – as learner cannot learn isolated facts or theories in abstract ethereal land, separate from real world situations.
6. ***Motivation*** is a key in learning to help us know how the acquired knowledge can be put to use.
7. ***Knowledge*** is important – as we cannot comprehend new ideas without some structure developed from prior knowledge to build on.
8. Learning is not ***instantaneous*** but takes time – as the learners must revisit principles, reflect on them and using them as often as possible.

**Constructivism: Issues and Challenges**

Today's education has been transformed by new technologies – due to the enormous data aavailable to learners. [6] notes that studies indicates that a technology rich class will observe the following:

a. Shift from whole class to smaller groups
b. Teachers coach weaker students rather than focus on all as with traditional settings. Coaching occurs rather than lecture and recitation.
c. Students become actively engaged, cooperative and less competitive
d. Students learn differently than simultaneously.
e. Integrate visuals and verbal thinking rather than verbal thinking primacy, as in traditional class.

The challenges of a constructivism is that educators, parents and learners are ***suspicious*** of the educational practices as it differs from what they are used. This is attributed to the fact that the constructivist learning removes ***statewide*** assessment because traditional educational model allows tests to be ***aligned***. Learners take ***standardized*** tests, which do not assess ***what*** they are learning and ***standard*** report cards with grades will pose a problem for both teachers and learners as class structure will be more ***fragmented***. Problems abound due to lack of funds and unclear vision to keep this systematic change from occurring as rapid as possible. Teachers charged with these duties of emancipating these students do not have a good understanding of how these technologies work and what amount

of information is available to them. This paradigm shift will require staff retraining and their roles be redefined to inform them to think about why they do what they do. Acculturation must also take place in schools even though the process be slow [23].

**ICT in Nigerian Schools**

Traditional education continues to change with ICT integration, as new training system are developed and applied with features that include [24]:

- **Open** – no restriction on time at which class is attended. This breakthrough removes the restriction in spatial limitations of the location of the classrooms and schools.
- **Initiative** – Students becomes knowledge producers as they determine how, when to learn and selecting the learning context and methods.
- **Individuality** – Students become masters via establishment of individual learning space as the most suitable textbooks is applied to each individual so that the potentials and capabilities of each student can be fully utilized and brought into play.
- **Communication** – brings about exchangeable study, so that students not only learn by listening and seeing, but can also communicate with other teachers and students through chatting and video conferencing. ICT has therefore become a power for academic revolution, as the achievement of these changes needs to be reached step-by-step.
- **Life Long** – As studying becomes a lifelong need and requirement to work and live in an information society and learning will become a lifelong activity as knowledge grows wider and wider.
- **Long Distance** – People can study at anytime and anywhere. Distance is no longer a restriction.

With ICT integration, teaching pattern and contents will change featute as thus:

i. Learning mode, changes from group to individuals.
ii. Passive learning changes from teacher-centered to self-initiating.
iii. Source of the knowledge will be changed from simple to multiple as provided by ICT.
iv. Periodic study will become lifelong learning.
v. Education will have the purpose of obtaining the ability to learn knowledge.
vi. Updating knowledge cycle will be more quickly

**Educational Approach for Info Evaluation**

For every teacher therefore that wishes to assert himself, he must realize that lifelong education becomes a necessity. The *tasks of schools* should be, to prepare students (on how to learn) and teachers (on effective ways to adapt these trends of delivery). The schools' main task will no longer be to primarily provide students with specific information, but also to teach the students on how to work independently. Because schools will not directly control the students' learning process, but only stimulate, direct and check student's performance and literacy levels. Hence, the educational sector changes from teacher-centered to student-initiated process. This will result to changes in student-teacher relationship, which is expected. Teacher will have to *educate* and *be educated* throughout their lives – and maybe sometimes, they will even have to also learn from their own students [6-7].

*ICT education* will aid both teachers and students will learn how to work with information. They will obtain technical skills to handle programs and computer equipments knowing the basic rules of application and so on. They must also learn how to look for, judge, critically evaluate, orient themselves, summarize and present information to all, which means the introduction of media education

in schools; while *Media education* is known as a set of activities leading to knowledge acquisition. This in simple terms can be viewed as the acquiring of basic knowledge of how individual media works such as the radio, videos and the modern interactive media known as *hypermedia* [24-25].

We must understand that if the teachers are able to join in the information society, then they must be able to evaluate information, which reaches them. More information is being transferred daily by electronic media in electronic format in every branch and aspect of life – so it becomes obvious that we have a measurement or yardstick for information assessment. A major aim media education is to form independent, critical approach to media and learning the rules of their work. It also has the usual acquiring abilities to discern the quality of individual information accessed. Media literacy is and will continue to be a major part of general teacher's qualification. Media education is not new but its importance is reiterated due to the development of ICT [26].

**Issues for ICT Integration**

ICT integration must not be underestimated and [27-30] notes that as with innovations before ICT – there are issues surrounding it as a mean of alternative delivery, which is largely dependant on the environment, such as:

1. **Staff Development** – Teachers must be retrained to be computer literate, to support online learning – as studies have shown that student self-paced learning places heavy demands on teachers who need to respond to students' needs?
2. **Cost** – Availability of computers knowing the cost implication, priority that must be placed on learning and cost implication of being online giving access to students from homes.
3. **Curricular** – Curricular restructuring to be made available in electronic form and what process is needed to maintain/ update courses in time?
4. **Administration** – Who develops, maintains and updates these learning sites? Who will assume stewardship responsibility of these sites? What technical support are there for teachers to use and update these sites or will teachers and schools be dependent on experts? How dependent are such schools on these sites, both from the technical know-how and staffing? Are there alternatives for these schools if these sites crash?
5. **Equality** – Will Government reduce cost implication of online-access to all students so they can have equal access opportunities by streamlining it into the pay package of their parents (her employees) and will workers not rampage bearing in mind that salaries are not same for all its workers? What is the fate of student from average homes to avail themselves of these opportunities?
6. **Learning Quality** – Students will seek evidence that ensures the learning quality and depth using such media over the traditional classes?

**Rationale For Ict Integration**

ICT in Eeducation must lead to a system that decides what students, teachers and the school aims to achieve. [25-27, 31] notes that there are three (3) main rationales for ICT integration is:

1. **Education Productivity** – is a ratio of output over input, viewed as the quantity and quality of learning demonstrated by the student over cost of materials. With the proper selection of input by teachers, learning is optimized with increased outcome. Productivity cannot be based on the fact that ICT media are expensive to install because cases may arise in which technology must be used because it solves a problem – if that part of the curriculum is

not completed due to lack of technology, its associated outcome is zero and productivity is zero.

2. **Technological Literacy** – ICT helps address problems in curriculum (rather than fit ICT into the curriculum). Education technology is selected on the basis that it has best feature for implementing the curriculum – as there is always a two-way relationship between curriculum and educational technology. ***Firstly***, policy makers decide what to learn (curriculum), after which technology and the method to be used is determined by the intended curriculum. ***Secondly***, new technologies in one case, adds new contents to curriculum; while making some contents obsolete in another case.

3. **Student's Learning Support** – There are much potential for the use of computers in learning but whatever the rationale, requires a critical evaluation on the part of students. We must bear in mind these criteria to be met on the learner's part: (a) managing high quality educational programmes requires large amount of data, which teachers must effectively help students manage, (b) Access to resource materials linked to teaching and learning (***online*** and ***offline***), and (c) computer literacy.

**SUMMARY**

This study contributes in 4-broad ways: (1) its outcome describes individual, group and organizational adoption of technology for teaching/learning across various schools/educational levels in its implementation, (2) images exemplary practices for teaching, learning and research; and (3) links technology integration, engaged students learning and staff development. Its significance is both theoretical and practical as:

a. It increases diffusion of innovations and application of ICT theories – showcasing the potential challenges with widespread encouragement and adoption of ICT integration in education to implement such outcome curricular across subject areas in schools.
b. It highlights systematic documentation of adoption pattern and characteristics of administrators and teachers willing to integrate ICT with the support of network facilities. The result of the investigation shows that the use of shared instrument for access of widespread information by both teachers and students alike based on the scale of engaged student learning and the stages of technology adoption, will form the foundation for the next step in the planning and implementation processes at each school. A useful info to all stakeholders in educations.
c. Teaching/learning mode in practice will provides the needed images of how ICT integration will be used for meaningful students learning outcomes. Such knowledge is useful at organizational and individual level for staff development in technology integration and further research in such areas

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**Recommendation**

The recommendations are as follows:

a. Government must fund ICT integration in our educational system and provide support and infrastructures – knowing educational reforms is not just the provision of ICT equipments.

b. Staff development scheme organized to equip and redirect teachers' focus to help emancipate their students. The schemes provide opportunities to effectively support alternative delivery.

c. Educational reforms must reflect ICT integration into curricular with reviews to Government for proper assessment and implementation.

d. School administrator should provide training plans to aid teachers better understand their new role and ***expected*** outcome as well as how they can navigate ICT as fully integrated into school curricular. Also Administrators and teachers, having gained insight to some of the issues of such integration, must equip themselves and make decision that will help alleviate these problems as they hold the keys to students success in this new education plan.

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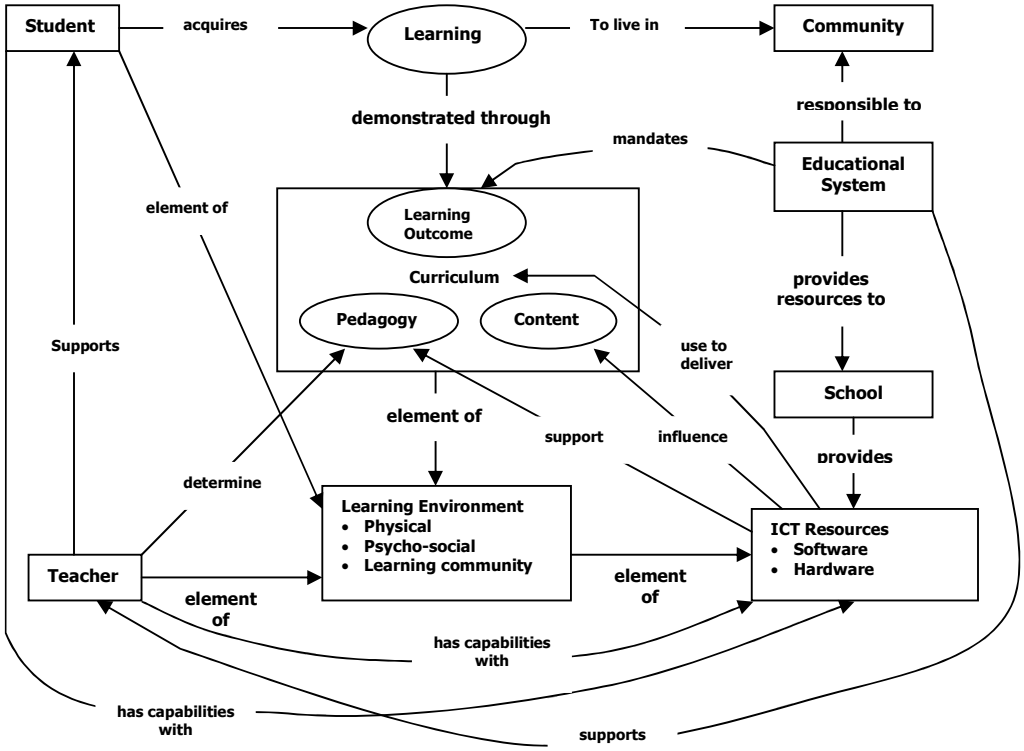


**Figure 2 shows concept map indicating relationships between the learning environment and external entities**