Internet Capabilities for Effective Learning and Research: A Review

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ABSTRACT

The Internet has continued to span great geographical space and generality interests. It has provided enough space for social interaction and information exchange. It is hard to imagine a world without the internet. Like other fields of human endeavours, the internet is no doubt revolutionizing the act of researching, especially in the sciences. Regardless of any viewpoint, research outlines formal, methodical and rigorous processes, specifically the application of scientific methods of problem recognition, definition, solution development, data collection, analysis and conclusions. Expectedly, the introduction of the Internet heralded the upswing of the new soft form of learning; with the aim of achieving speedy and cost effective diffusion of knowledge. Secondly, the internet has also helped in aggregating with ease such knowledge which can be shared amongst geographically-detached partners. So, whether it involves fundamental/pure or basic distributed research, action, applied research or research and development, the internet could be effectively employed to improve and meet the limitations of information synchronization, speedy information verification, and reduce the time and the cost of conducting research. In this paper, we propose a structured step-by-step internet-assisted research model that explores known methods like web surveys**, n**onreactive Internet-based methods, web-based psychological testing and web-based experimenting. Theyinclude research features such as Research and Grants Acquisitions, Information Aggregation, Communication and Collaboration, Data Selection and Analysis, Publishing. Also, it involves exploring popular internet services like electronic-mail, web directories, World Wide Web (WWW), VoIP Conferencing, News/Mailing Lists, Chat Applications, File Transfer Protocols etc. The internet is surely one remarkable point for engaging various tools for research that cannot be ignored by modern day researchers.

Keywords: Internet research, Online research, Scientific research, Research in science.

INTRODUCTION

Research as we know generally has not enjoyed the luxury of unified definition. However, its concepts are not far-fetched as several schools of thoughts have construed or better still absorbed self-suiting definitions which eventually does not stray too far from common concepts. Not minding the perspective, research generally outlines a formal, methodical and rigorous process of searching out a particular idea or a structured body of knowledge. It has been defined as "the systematic, testable and objective analysis and recording of controlled observations that may lead to the development of generalizations, principles or theories"[1]. More specifically, scientific research outlines the application of scientific method (problem recognition, problem definition, solution development, data collection, analysis and conclusions) to investigation of problems[1]. In the time past, scientific research methodologies have all assumed manual procedures as the means to an end. This phenomenon is gradually changing form today with the advent of digital technologies; more specifically; the internet Technology. Since its inception, the internet has spanned geographical space and generates interests, great weights in changes to information dissemination, commerce and interaction[2], and it has not left its mark in the domains of scientific research either. Dwelling on the motivations of knowledge propagation, scholars have continued to pursue and respond to the dynamism of research, especially the changes in 'How' research is being carried out. With the internet, these '*hows*' are changing over time, and as another scholar puts it, "the Internet is perhaps one of the most revolutionary developments with profound impact on research process and dissemination of information"[3] in[4]. Truly, the introduction of the Internet prefigured the rise of a new form of learning material; the soft form. The utmost advantage of which has been and still is the diffusion of knowledge within a shorter time and at marginal costs globally via a network of computers[4]. The internet has also transformed the way scientists and (or) researchers collaborate. How? By increasing the comfort with which they can share information and work with geographically distant partners[5] in[2].

Like it has been, data and information are gradually changing habitation (from physical or manual to digital environments). Given that research is mainly focused on data and information, it is only ideal that research also respond to same technological switches to ensure utmost relevance and profitability. Already interests are already underway, with scientific scholars changing their research course and stooping to the internet for better and more convenient research experience. For instance, a Web Survey Methodology (*WebSM*) revealed that research via the internet accounted for $960 million in spending in 2004. Same survey indicated that 8% of survey studies in 2001 were performed through the Internet. The number rose to 60% in 2004[6].

Thus, this study is aimed at exposing learner and researchers to the potentials for exploring the internet for academic purposes. Specific objectives include; unveiling how much changes and impacts the internet has done to learning and research in comparison to the traditional methodologies. Showing some practical ways in which researches can be engaged using the platform of the internet and showing through review of existing literature, a structured approach (model) for engaging the internet.

The world is indeed changing, and so is everything about it. The knowledge gained from this discourse will become

useful to both staff and students of tertiary institutions in Nigeria. The study would also provide reference point on the effective internet skills like the concepts of search optimizations. The remaining parts of this work are structured as follow; section 2 gives an overview of the internet, outlining its key characteristics. Section 3 covers details about review related works that that shows previous research efforts on uncovering the significance of the internet to educational learning and research. Section 4 emphasizes more on how the internet could be leveraged as a tool for effective researching, with practical steps and techniques that could be applied for achieving good research endeavour via the internet, while section 5 forms the concluding part of the work with recommendations.

Overview and characteristics of the internet

The internet is a public communication system. There are two key characteristics that distinguish it from other communications systems which are the specific protocols and services it offers. The internet is essentially a global network of networks (computers and other electronic devices) which provides a variety of resources, several services and assorted data. These services/data can be in form of applications which must run with a set of standard protocols like the physical layer such as WiFi, network/transport layer such as Transfer Control Protocol/Internet Protocol (TCP/IP) and the presentation layer such as Hypertext Transfer Markup Language (HTML) and Moving Picture Expert Groups (MPEG) format of file/data. These protocols require hardware and software tools for implementation. The examples of the services or applications includes domain name resolution, the www (e.g. Websites, forum, blogs), e-mail services like Gmail, search engines like

Google, open sourced software (e.g. WordPress, Drupal), download services (e.g. music, game, apps, video, etc), e-commerce services (e.g. books, electronics, etc), social networks (e.g. Facebook, MySpace, etc), voice communications like internet calls, audio and video conferencing, instant messaging (e.g. Yahoo messenger), etc. Like the protocols, these services also require hardware and software tools for implementation like a computer system/ laptop with the required operating system. The Internet presents scholars with several opportunities. Like we noted earlier, it could lower the costs associated with data collection, and could be used for online experiments and surveys, it could allow observers to monitor trend changes, and offer the mining of archival data sources to mention a few[2].

Internet learning and research potentials: Related works

Typically, learning and research are both characterized by various activities which collectively point towards the same goal; projecting knowledge.

With emphasis on learning, the internet is labeled a rich, multidimensional, and ever-changing textual environment[7], commonly used as a medium of communication among students and researchers in higher institutions. A related work by[8], records that most of the links between universities' homepages were connected to information on education or research. Similarly, internet usage has impacted positively on critical thinking, problem solving, prompt feedback and networking[9].

A survey of over 2000 teachers,[10] disclosed that most teachers are likely to use internet for learning or educational purposes rather than for entertainment. This supports the findings of[11] whose report revealed that more than 90% of sampled lecturers

designated that the internet had topped the value of their academic pursuits with regards quick access to research resources.

Another research showed that more than 74% of respondents (majorly students) admitted to using the internet for learning and educational purposes[12]. It is reported that most students use internet because of its alleged effectiveness for information access on assignments and research projects[13]. Particularly, an average of 3.5hrs per week of internet usage is reported among undergraduates in Nigeria[14] buttressing on the point of students' perception on the significance of the internet. Thus, the internet is posed to increase student access to learning, boost curriculum and quality of instruction, and increase academic productivity[15].

A nearly related study was undertaken for secondary school students by[16] to evaluate the level of awareness in the use of Internet for resources gathering, and determining the potential resources generated from internet-assisted research as compared to traditional library system research. The outcome showed …. a substantial variation in outputs between traditional library system research and internet-assisted research. The result showed that the internet offered better prospect for greater productivity and relevance of contents, as well as present learner with refined and up-to-date information.

A study by[17] shows that some of the most basic motivations for students going online include; school assignments, research, e-mails and social interactions. The use of the internet for research or academic purposes by tertiary education students is further buttressed in[7,18,19]. This is further consolidated today, by the fact that most higher institutions of learning now maintain online presence with journals, newsletters, books and magazines access for staff and students[7]. Additively is the latest

capability for e-learning (covering e-registrations and e-assessments). It can thus be concluded that using internet for learning and academic purposes is not utterly new[14].

Further empirical research which focused on determining the potentials of the internet in enabling research in Nigerian universities using Obafemi Awolowo University Ile-Ife, Nigeria as case study showed an improvement on the level of internet usage and frequency of use for undergraduate students[20]. Implying that, a significant number of the student populations were open to the use of the internet for learning and academic purpose[20].

The authors in[2] outlined some key research activities like Information Gathering, Communication, Data Collection, Publishing, Teaching and Grants Acquisition. The Internet supports and incorporates scientific activities, and brings about a more rapid research progressions. The Internet has ensued great, constructive impacts on the conduct of research, both by altering the costs, energy and resources needed for attaining research, and by making visible interesting research sensations that do not exist in conventional situations[2].

Apparently, the strength of the internet lies in the unparalleled growth of its network globally and its capacity to link computers and several individuals short of geographic space barriers. It has been much-admired as one of the most momentous technological developments of the 20th century and is viewed as poised to impact academic research significantly in the near future.

The internet as a research tool

The internet indeed possesses great power. The invention amasses great features and opportunities that cannot be ignored or snubbed. Other spheres of human

endeavours have not snubbed it, and the sciences would not either. In this Information Technology age, conscious of the invaluable roles and contributions of the internet to global development, we argue that scientific research can only get better if like others, it pitches it tent with technology, specifically Internet Technology, leveraging the powerful features and openings the internet promises and unveils.

Conventional scientific research methods follow standard procedures like pointed earlier, which are somewhat unavoidable if significance is to be achieved. The basic features of scientific research are seen to be catered for by the internet, making the internet path a must-take for modern day researchers. Furthermore, scientific research can only be considered acceptable, when the basic principles of universality and transparency are achieved and maintained[21], these too, the internet accommodates. In fact, the violation of either of these bi-principles amounts to a misrepresentation of scientific research as well as the internet[22]. Without a doubt, the web or internet is potentially our modern-day research gizmo.

The activities of modern-day, Internet-compliant researcher is characterized by long hours sitting in front of a computing screen; perusing electronic pages (self-configures and otherwise), gathering information, collaborating with other researchers via emails, Internet Relay Chats (IRC), Newsgroups, and blogs, accessing and submitting publications and reports generated through data mining techniques, online surveys and (or) web experiments. As a research tool, the internet affords both the means and ends to these activities. The means is expressed in the internet's positioning as a medium for exchange of information, domain for publishing researched contents and (or) findings. As an end, it yields an area for piloting research, an abode where researchers explore different traits of logical groups, and engaging in interactions via bulletin boards and real-time internet conversations or meetings[21].

From existing literatures, and the overview of conventional research activities, we thus propose an Internet-Assisted research model that assumes a recurrent nature. This model explores the characteristics of typical scientific researches, outlining the basic activities that are likely to be engaged while doing research using the internet medium. The model components include; Research and Grants Acquisitions, Information Aggregation, Communication and Collaboration, Data Selection and Analysis, Publishing. Although other researchers have mentioned some of these activities, none has considered the need for maintaining a structured flow or transition from one stage to another. Our work seeks to propose such a model to help guide researchers in exploring the internet for effective research. We observe these to be valuable research features that have enjoyed the benefits of the internet, and are being transformed from their traditional approaches to a more productive, speedy and more convenient internet-assisted approach. (See figure 1.)

Information aggregation

The internet domain offers easy access to nearly limitless information. With the global connectivity of millions of servers harbouring data and information, access to the internet implies access to these servers for resources required to meet scientific research ends. And, obviously, information gathering is sustained mostly by search engines (Google, yahoo, msn, Ask etc), specialist websites, and aggregation engines (e.g., folksonomies like Flickr, or YouTube), and specifically by scientific data-mining services

(e.g., Google Scholar and Web of Science in biblio-metrics)[21].

Unlike in the past, Information currently available on the internet take different forms ranging from text-only data, audio and video formats etc. These could be acquired depending on user needs, skills and search proficiencies. The concept of optimized search otherwise referred to as 'search engine optimization, SEO' has helped simplify further the ease at which specified information can be derived from the internet. SEO phenomenon projects an art as well as a science of helping or aiding easy and speedy location of information on major searches[23]. It makes website contents to be more visible to users[24]. With such technologies, access to university electronic libraries, archives, research centre archives, conference proceedings, journals and information data bases all come much easier and at less expense both financially and physically.

Communication and collaboration

Communication is typically the act of sending messages; which again is an important activity in scientific research. Conventionally, this is achieved via manual/paper, hard-copy mails (post office letters, memo etc) to research associates to communicate and (or) exchange research findings or requests, which traditionally takes a sluggish turn, slowing the general research process[4]. However, with the internet, communication with colleagues around the world has increased in speed and quality[21].

Since the launch of electronic-mail (e-mail), and given the small bandwidth requirement for emails and its mostly text-only nature, e-mails are about the most widely used internet service; allowing for easy and cost effective access by many research centres and educational institutions[21]. E-mailing is noted to be considerably the most common internet activity, with about 90% of all internet user claiming to be active e-mailers[25]

in[21]. Interestingly, newer technological developments in the forms of social networking, and the recurrent improvements in connection speed and bandwidth usage for, paving way for the emergence and adoption VoIP systems (Skype, Tango, etc) that allow for hosting virtual meetings and research collaborations without much technical difficulties.

As could be discovered, the internet affords a means for side-stepping most of the limitations of 'academic freedom'; given that it disregards topographical borders and unveils the potentials for evading suppression of scholarly articles in print media[4]. Hence, the internet is not docile to the austere, unbending controls of governments as it applies to print publications, a plus that publishers continue to leverage upon.

Data selection and analysis

The art of collecting data or sample data selection is an indispensable part of scientific research process. And of course, this is submitting to unparalleled historical transformation in scale and number of opportunities in the sciences[26]. Just like the traditional methods of data collection and (or) selection (surveys, interviews, questionnaires, etc), the internet provides for the extension of such processes into the digital space. Today, with the use of various web application technologies like HTML, XML, PHP, ASP, etc, and 'killer applications'[21] and VoIP schemes, researchers can convenient reach out and in fact harness desired research data from varying respondents with predefined analytical structures that enables the ease of making inferences without much difficulty.

Publishing

Publishing is another facet of research that has witnessed tremendous change with internet influence. Computerization and (or) digitization has affected automation, workflow and publishing process integration

readily expressed in forms of blogging and social/cross media. The most alluring advantage of this developmental phenomenon is the potential riddance of the formerly difficult requirements (elongated publications processing including payment modes) that often delayed or even repressed the unrestricted flow of research submissions and communications[21].

Even more interesting, is the fact that scientific researchers and their institutions are fast tending towards embracing online and (or) open access publishing and institutional or individual self-archiving[21]. In physics as an instance, the process was initiated quite early and is near completion, credits to a formidable, strong-willed efforts of enterprising individuals[27] in[21].

Today, the numbers of online (published) scientific journals are in their thousands and continue to grow daily. For instance, *the Journal of Medical Internet Research*, *the International Journal of Internet Science*, and *the Journal of Computer-Mediated Communication* are all exclusively online journals. Some others like the journals of Atmospheric Chemistry and Physics combine open access with collaborative public review, enabling editor (s) quick checks of submitted manuscripts and eventual publishing as discussion papers[21]. Statistically, it has been revealed that self-archiving or peer-reviewed online publications are more acceptable now by journals with 93% for author self-archiving[28]. Interesting today, articles that are presented online are cited more frequently perhaps because they are simply more reachable[29,30] in[21].

Intertwined with publishing is the concept of citation analysis which defines the theory of studying the influence and presumed worth of an article, its author or his institution derived from the number or frequencies of such article (s) and (or) author (s) is cited by others. Information aggregation

systems like Google Scholar, and Thomson Scientific Web of Science amass lots of references that can be analyzed, with possibilities for articles trace-backward and forth. With these, locating similar articles and reference list comes easy, can be found by overlap of reference lists. Developing research trends and areas can easily be spotted by monitoring publications with quickly increasing citations rates[21].

Research and grants acquisitions

Grant Acquisition is yet another aspect of academic research that has leveraged on the strengths of the internet[21]. Usually, grants follow laid down processes that have enjoyed simplification with the emergence and use of the internet. Online-learning concept is diffusing; and this is eagerly being incorporated into research activities. Today, Funding and (or) research-donor agencies convey research interests and guidelines through their websites, funding applications, proposals, and other research requisitions can be submitted via online mediums (online forms and emails), grants and research sponsorship procedures can also be accessed online thanks to the online capabilities of e-banking.

Given that research evolves and it processes are continuous, we suggest this model should assume a recurrent nature, as might be considered necessary to ensure invaluable output. Hence, the arrow signifies potential transitions from one stage to the order, which could be repeated as many times as possible following the goals of result improvement or upgrade[21].

Online content search capabilities: Good search strategy and filtering method

Researches can be made effective by using the correct syntax, strategy and operators. These allow any internet researcher to create more detailed search criteria. Once an effective search criteria is created, the

search assistant performs the search and display the results from sites that most closely match the search chronologically[31]. The application of these strategy and filtering methods will increase the precision of your research and make your results accurate. This is a very good way to leverage the power of the internet for researchers. A range of search engines use the following syntax to create more sophisticated searches: CAPS, +, -, ", * and Boolean operator like AND, OR and NOT. Their applications are explained as follows:

Capitalization method

When names (especially English names) and captions are capitalized, the search engine treats it as single name or title. For example, the search '*FEDERAL UNIVERSITY LOKOJA*' will get exactly the match while '*Federal University Lokoja*' will get the match as well as '*Federal Bank'*, *'Federal University Owerri', 'Federal Court'*, etc. If the researcher does not capitalize the name or title, it will be treated like any other group of words, and sites relating to any of the words will be presented. However, lower case search will produce matches of capitalized words. For example, '*mercy*' will find matches for 'mercy', '*Mercy*' and '*MERCY*'. Also, capital letters in a search will provide an exact case match on the entire word. For example, submitting a search for '*MerCY*' will search only for matches of '*MerCY*'.

Quotation and hyphenating strategy

Double quotation marks (" ") can be used around words or hyphens (-) between words that must appear next to each other. When quotes or hyphens are used, the words appear together. For example, "*research in the sciences*" or *research-in-the-sciences* (note: there are no spaces) will find sites with those words adjacent to each other. If the quotes or hyphen is not used, the search

engine will find sites that include the word sciences and research.

'Addition' technique

More Tips Using a plus sign (+) in front of a word that must appear. To require a word, and increase the precision of your search, type city guides + London. Do not leave a space between the plus sign and the word that must appear.

'Subtraction' technique

A minus sign (-) should be put directly or closely in front of a word that must not appear in the search result. This is the simplest technique to exclude a word from your search. For example, *science-biology* will locate sites on all aspects of science excluding biology. The addition and subtraction techniques can collectively be called *operator technique*, using the + and – symbols to include and exclude words and phrases respectively.

Star notation (Truncation) strategy

An asterisk (*) can be used to search for partial matches or alternative spelling. For example, looking up for the word kill* will match sites containing killing, kills, killed, killer, etc and looking up for favo*r will find matches for both the British English favour and American English favor.

Boolean technique

This technique simplifies a complex search by using the keywords AND (to require both terms), OR (to match one or both terms), and NOT (to exclude terms). The use of parentheses to group words and quotation marks to indicate phrases is also applied in Boolean searches. For example, *king AND queen AND NOT* ("*Queen of Nigeria*" *OR coronation*) will search for pages that contain both words "king" and "queen" but not the phrase "Queen of Nigeria" or the word "coronation".

Exclusion strategy

It is a good practice to exclude words like "a", "the", or "it" from the search criteria. Searching for *joy + son* will provide an effective result than searching for *the joy of a son*.

Some search engines allow matching of files of a particular type like multimedia types while most search engines allow controlling the number of links returned per page and to exclude links to potentially offensive material. The Advanced or Help links on the search engine's home page will offer specific strategies for itself.

CONCLUSION AND RECOMMENDATION

Whatever the status of researching today, the reality is that the internet has contributed immensely to the current statuesque. With possibilities for gathering information, online libraries with millions of volumes of resources accessible with ease. Indeed the internet has positive implications for learning and research in the academia, especially in tertiary institutions.

We suggest thus that modern researching should be characterized by the application of modern techniques to modern areas to yield modern knowledge. This status will not be far-fetched if the limitations of low or complete lack of internet (research) skills, low literacy to computing, inefficient internet services, low or zero knowledge and understanding of internet research capabilities and applications, could be greatly minimized or done away with. Notwithstanding the odds, the cumulative proof of how the Internet is outdoing paper media worldwide and gradually dealing saturation to the aforementioned deficiencies. It is only rational that today's scholars take internet (online) researching more seriously. It is therefore suggested that researchers can make effective their researches by embracing and submitting to internet proficiency trainings,

adopting effective internet research tools, and techniques, by using the correct syntax, strategies and operators. This will overall yield more detailed search criteria and results.

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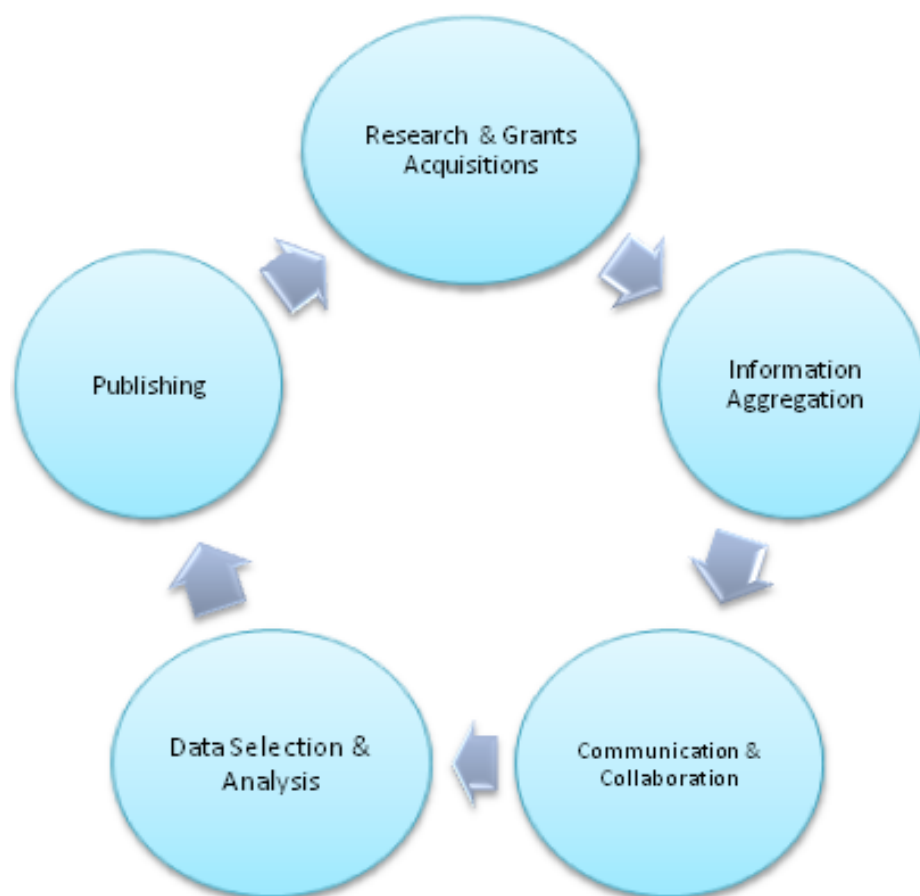
Figure 1. Internet-Assisted academic research model