Impact of Information Overload on Students' Learning: An Empirical Approach

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There is no doubt that in this age of information and technology, whole world is overloaded with relevant or irrelevant information. The term 'information overload' refers to different conditions, such as the quantity of information, the processing of information or the retrieval of information. The purpose of the study was to determine the impact of information overload on students' learning. A questionnaire was designed for data collection which contained both open ended and close ended questions. Data were collected from 360 randomly selected students of M.A. second year from the five departments of Institute of Education and Research, University of the Punjab, Lahore. Results revealed through descriptive and inferential statistics that most of the respondents preferred to use technology or computer generated information which provide visuals, illustrated text and power point presentations. Results further revealed that information overload do not affect students' learning somehow as their interpersonal and communication skills were strong and sharp enough.

Key words: Information overload, students' learning

World is shifting into an information revolution, leaving the industrial revolution behind and this brings an explosion of data and information for which an individual may (or may not) have any use or need (Gifford, 1992). The term 'information overload' refers to different conditions, such as the quantity of information, the processing of information or the retrieval of information. Also, information overload is defined in a variety of ways, suggesting that it means different things to different people (Burge, 1994; Fournier, 1996; Rudd & Rudd, 1986). Whereas it is defined in McMillian Web Dictionary as "A situation in which you get more information than you can deal with at one time and become tired and confused."

Learning can be defined as relatively permanent change in behavior as a result of knowledge and experience, (1) learner is changed after the learning occurs, (2) the knowledge of the learner is changed, (3) the main reason of this change is learner's experience (Mayer, 2011, p. 14). One operational definition cannot measure the process of learning. In contrast to this, learning emphasizes on retention, transfer of knowledge and comprehension. According to Butler (2010), many research studies tried to distinguish the similarities and differences in initial learning and its subsequent transfer.

Working memory refers to the information that an individual can hold at one time (Sweller, 1988). Cognitive load is also related to working memory. The additional activities should be avoided during the process of learning that directly contributes to the over loading of working memory because working memory has a limited capacity. The amount of information supplied to the learner during the process of learner had gone numerous changes in recent times (Bawden & Robinson, 2009). According to Meinz and Hambrick (2010), working memory capacity is the ability to maintain task relevant information in a highly active state. The working memory of every individual is different as compared to each other and it also affects the learning process (Austin, 2009).

The provision of adequate information to the learner has been a controversial issue form the past decades. In early Egypt and Sumerian, the information was recorded in written scripts, clay tablets and papyrus scrolls and this information was communicated across time and space. In this era, the information was hand written and the books and journals were also printed. Some quotations from this era also threw light on the overload of information. The failure to read written menu scripts is related to the overload of information.

The modern form of information overload began to appear in the nineteenth century after the publication of many academic journals and books. Even an individual cannot remember all the information in the subject of his/her subject. There was a problem to find appropriate material on the information overload since then. Since the expansion of internet, situation became impressive because it was very easy to find a lot of information on any topic (Bawden & Robinson, 2009).

Bawden and Robinson (2009) question the authenticity of material which is available on the internet on any topic. The provider of this information is also confused then the next question arise that how this information is valid and reliable.

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With less availability of adequate material, individuals often make poor decisions. Since the amount of information increases the information processing so the process of decision making becomes more effective. After some time, the amount of information is saturated and individual is unable to process this information. This is the time when the information overload occurs and it also affects the ability of decision making of an individual. The information that is beyond this point cannot be processed and it also impacts the abilities of an individual to set priorities based on the previous information (Eppler & Mengis, 2002).

Jones and Araje (2002) also pointed out in his research titled "No knowledge but through information", the order of these three terms i.e. data, information and then knowledge and he argues that we can handle information like something else. Information can be stored in the form of email messages or documents which can be sent, retrieved, received, deleted and even manipulated.

Computers have revolutionized the process of information because enough information is available on the internet and every individual can access it. It is very easy to access any type of information if anyone can have his/her personal computer (Fischer, 2001). Now adequate data is available on the internet on any topic as compared to ten years ago. But humans cannot absorb and process all that information due to some certain limitations (Chun, Golomb, & Turk-Browne (2011)

Constructivist Learning Theory

Constructivism is a theory which explains the mechanism of how people obtain knowledge. The basic idea of constructivism is that problem solving which is dealt with the process of learning, thinking, and development. Learners solve problems and discover the consequences of their actions through reflecting on past and immediate experiences then they construct their own understanding. Learning is thus an active process that requires a change in the learner. This activity is occurred whereby learner engages in, including the consequences of those activities, and through reflection. Therefore constructivists believe that learners only deeply understand what they have constructed.

Christie, (2005) argues that constructivism is the learning theory which established learning as the active process in order to achieve knowledge. Knowledge is constructed and shaped by experience. Constructivism leads one to achieve knowledge through his own experience. Moreover, it emphasizes on problem solving and understanding and the instructors are necessary to use authentic tasks, experiences, assessments also the content of subject presented holistically not in smaller parts. Fosnot (1989) defines constructivism according to four principles: (1) learning depends on what individuals already know, (2) new ideas occur as individuals adapt and change their old ideas, (3) learning involves inventing ideas rather than mechanically accumulating a series of facts, (4) meaningful learning occurs through rethinking old ideas and coming to new conclusions about new ideas which conflict with our old ideas.

The current survey study is basically student centered and would help in highlighting problems faced by the students with the information overload. From where is this information load coming from, i.e. different resources or due to their own lack of meta-cognitive skills, lack of facilitation, communication gaps, language deficiency, computer skills expertise, access to the latest information retrieval facilities etc. Moreover, this study is highlighting the importance of human element involved in the learning processes, which plays significant role in generating and at the same time dealing with the information overload. More attention given to the learner while planning the curriculum, designing instructions, providing facilitation or creating learning environments would help teaching authorities to plan in an effective manner to reduce the information overload and enhance students' learning.

Objectives of the study

The objectives of the study were:

1. To investigate the awareness among the learners about different resources of information.
2. To explore feelings of the students, when they are exposed to information overload.
4. To investigate the text type or assignments that is helping the students in managing their information overload.
5. To investigate the effect of computer literacy on information overload management and the learning outcomes (CGPA) of the students.

Research Questions

1. What type of information resources were preferred by the IER students the most?
2. What is the role of the students' proficiency in their computer skills on their information overload management?
3. What is the effect of information overload on the students' learning (in terms of their CGPA)?

Method

The present study attempts to investigate the impact of information overload on students' learning. The study was of mixed-designed nature i.e. both quantitative and qualitative approaches were used. Cross sectional survey design was used for the study, because of the limited time availability.

Sample of the study

All the postgraduate students of the University of the Punjab, Lahore were the population of the study. Simple and stratified random sampling technique was used to select the sample. From eight departments of Institute of Education and Research of University of the Punjab, five departments were randomly selected at first. Then 360 master level students of the final year from the morning and self-supporting programs were selected because of their extensive exposure to information overload.

Instrumentation

A questionnaire was developed to collect the data from students. It contained both open ended and close ended questions. It contained three main sections i.e. demographic profile, close ended and some open ended questions which helped to collect both quantitative and qualitative data. It contained items relating to the demographic profile, information resources and their usage, feelings about information overload, information processing skills, time management skills and information related communication, available facilitation and learning assessment in the form of CGPA of the students. The researchers consulted with three experts to ensure the validity and reliability of the questionnaire and to ensure its validity and reliability. Moreover pilot testing was done on 40 students of Master of Educational Research and Evaluation Department. As per feedback of the pilot study, one question was omitted and the language of some items was changed for the clear understanding of the questions. In question number 1 options provided for resources usage was also changed i.e. there were four options like daily, weekly, monthly or rarely usage which were later changed to yes or no only. To calculate reliability, Cronbach Alpha was applied which was 0.898.Three questions were rephrased. Although the questionnaire was long but all other questions were accepted.

Results

Predictive analysis software i.e. Statistical Package for Social Sciences (SPSS ver.20) and NVivover.11 software were used for data analysis according to the nature of the data. Both descriptive and inferential statistics were used for data analysis. The data analysis is given below.

Table 1

Different resources, their usage and reasons to use them

Information resources, usage and reasons to use	Yes	%age
T.V	298	82.8
Use to collect information	165	45.8
Use to share info, ideas or any other content	89	24.7
Personal and social messaging	59	16.4
Any other reason to use this resource	49	13.6
Handouts	291	80.8
Use to collect information	214	59.4
Use to share info, ideas or any other content	114	31.7
Personal and social messaging	23	6.4
Any other reason to use this resource	6	1.7
Text books	296	82.2
Use to collect information	240	66.7
Use to share info, ideas or any other content	105	29.2
Personal and social messaging	19	5.3
Any other reason to use this resource	6	1.7
Libraries	285	79.2
Use to collect information	227	63.1
Use to share info, ideas or any other content	103	28.6
Personal and social messaging	31	8.6
Any other reason to use this resource	8	2.2

Total students=360 (including missing values)

Table 1 shows that 82.8% students of IER used T.V., handouts (80.8%), textbooks (82.2%) and libraries (79.2%) as paper printed information resources. It shows that most of the students still rely on these paper printed information

resources.82.8% students use T.V. and out of these, 45.8% students use it to collect, 24.7% used to share the information, ideas or any other content. Only 16.4% students believed that it could be used for personal or social messaging.Many students (82.2%) used textbooks. They used it to collect the information (66.7%), to share their information, ideas or content (29.2%), whereas 93.1% of the students were convinced that textbooks cannot be used for personal or social messaging.

More than three-fourth of the IER students preferred libraries. They used libraries (63.1%) to collect the information, to share their ideas, content or any other information (28.6%) and only 8.6% believed it could be used for personal or social messaging. Moreover, 80.8% of the IER students were using handouts. They used handouts (59.4%) to collect the information and 31.7% believed they could use it to share information and some content as well. 6.4% believed that it cannot be used for social or personal messaging.

Table 2

Computer generated information resources

Information resources, usage and reasons to use	Yes	%age
Intranet	274	76.1
Use to collect information	155	43.1
Use to share info, ideas or any other content	114	31.7
Personal and social messaging	85	23.6
Any other reason to use this resource	9	2.5
Internet	339	94.2
Use to collect information	188	52.2
Use to share info, ideas or any other content	143	39.7
Personal and social messaging	113	31.4
Any other reason to use this resource	12	3.3
Social media	303	84.2
Use to collect information	125	74.7
Use to share info, ideas or any other content	123	34.2
Personal and social messaging	132	36.7
Any other reason to use this resource	7	1.9
Web communities	194	53.9
Use to collect information	140	38.9
Use to share info, ideas or any other content	117	32.5
Personal and social messaging	76	21.1
Any other reason to use this resource	7	1.9
Video lectures	139	38.6
Use to collect information	180	50.0
Use to share info, ideas or any other content	94	26.1
Personal and social messaging	38	10.6
Any other reason to use this resource	7	1.9
Any other resource	27	7.5

Total students=360 (including missing values)

Table 2 provides us with the information that almost half of the IER students like to use World Wide Web related information resources. Internet was used by a remarkable majority i.e. 94.2% of the students of IER. Where 52.2% of students were using it to collect the information, 39.7% were using it to share the information, ideas or any other content and 31.4% were using it for personal or social messaging.

Second most used web related information resource is social media i.e. 84.2%. 74.7% students used social media to collect information, 34.2% used it to share information, ideas or any other content and 36.7% students used it for personal or social messaging. Then intranet was used by 76.1% of the students, which makes it third most popular World Wide Web related information resource. Where majority (43.1%) of the IER students used it to collect information, 31.7% used it to share information, ideas or any other content and only 23.6% of the students agreed to use it as a medium of social or personal messaging.

Web communities were used by 53.9% of the students. In which, 38.9% used it to collect information, 32.5% used it to share information, ideas or any other content and 21.1% used it for personal or social messaging. Video lectures were used by only 38.6% students. In which half (50%) of the students used it to collect the information, one fourth (26.1%) of the students used it to share the information, ideas or any other content and only 10% used it for personal or social messaging.

Table 3

Information processing skills

No.	Questions	Yes	%	No	%
1	Do you look at the author, website or the source of information?	291	80.8	66	10.3
2	Would you continue reading, if information is irrelevant?	124	34.4	235	65.3
3	Would you like to go through the information which is easy to comprehend/analyze?	300	83.3	60	16.7
4	Do you feel making small decisions like skipping, scanning, selecting the text while going through that information?	307	85.3	48	13.3
5	Do you try to relate your new information to your already existing knowledge?	315	87.5	44	12.2
6	Do you feel new information is sometimes thought provoking?	283	78.6	73	20.3
7	Do you feel given assignment is helpful in adding up to your knowledge?	307	85.3	52	14.4
8	Do you ever felt sleepless because you have too much information on your mind?	187	51.9	168	46.7
9	Do you find yourself becoming forgetful or indecisive because you have too much on your mind?	220	61.1	136	37.8
10	After finding the relevant information, you feel satisfied and stop searching?	241	66.9	116	32.2
11	If yes, do you want to sit there and keep using that resource more and more?	228	63.3	124	34.4
12	Do you find yourself with insufficient time to do things you really enjoy?	244	67.8	113	31.4
13	Do you find it easy to complete the assignment on time?	281	78.1	79	21.9
14	If you find new resources or websites, would you share it with others?	312	86.7	44	12.2
15	Do you wish you had more support or assistance (while doing your assignment)?	254	70.6	102	28.3

Table 3 shows that 80.8% of the students look for the resource of the information, author or the web site before they go into the details of the information. 65.3% students admitted that they would discontinue going through the information if they feel the information is irrelevant and 83.3% would like to continue going through the information that is easy to comprehend or analyze. 85.3% acknowledged making small decisions like skipping, scanning or selecting the text while going through the information. Moreover 87.5% felt like relating newly found knowledge to their already existing knowledge. 78.6% believed that new information is sometimes thought provoking and 85.3% agreed that the given assignments were usually helpful in adding up to their knowledge.

If faced by information overload in different educational scenarios, almost half (51.9%) of the students felt sleepless, 61.1% felt being forgetful or indecisive. Whereas 66.9% of the students stop searching and felt satisfied after finding the relevant information, even after that 63.3% of the students wanted to use that resource more and more, it just become a habit for them to search. 67.8% students of IER accepted that due to information overload they don't have sufficient time to do things they enjoy and only 21.9% of the students could not complete their assignment on time. 86.7% students of IER would like to share the new resources or websites with others and 70.6% wished that they could have more support or assistance while completing their assignment.

Table 4

Relevance of information

No.	Questions	Yes	%age
16	If lots of relevant information is in front of you, how do you feel?		
	Stressed	67	18.6
	Irritated	54	15
	Can't Concentrate	32	8.9
	Challenged	103	28.6
	Normal	106	29.4
17	If you can't find relevant information, how do you feel?		
	Stressed	92	25.6
	Irritated	78	21.7
	Frustrated	110	30.6
	Challenged	41	11.4
	Normal	45	12.5
18	If more than one assignment is given to you, how do you feel?		
	Stressed	104	28.9
	Irritated	60	16.7
	Frustrated	55	15.3
	Challenged	91	25.3
	Normal	55	15.3
19	If you find relevant information but confusing, you would:		

	Skip that information	59	16.4
	Try to find an easy one	172	47.8
	Keep struggling(try to deal with it)	111	30.8
	Come back to it later	50	13.9
	Ask for help	99	27.5
20	Which type of material you would like to use to collect the information:		
	Easy text	166	46.1
	Complicated text	27	7.5
	Illustrated text	34	9.4
	Audio	54	15
	Video	86	23.9
	Power point presentations	189	52.5
	Authentic text	146	40.6
	Reliable text	137	38.1
21	Which type of assignment would you like the most?		
	In which you could be more creative (goal free)	203	56.4
	Tasks on given specimen (worked examples)	79	21.9
	Complete the task (start is given to you)	131	36.4
	Copy, paste and present	73	20.3
	Small projects	126	35.0
	Any other	14	3.9

Table 4 presents that if the students were faced by a lot of relevant information, 29.4% felt normal, but28.6% felt challenged by that information overload. Whereas 18.6% felt stressed, 15% felt irritated and 8.9% complained that they can't concentrate as a result. If students can't find relevant information, 30.6% students felt frustrated, 25.6% felt stressed,21.7% felt irritated and only 11.4% students felt challenged by the situation, whereas 12.5% felt normal. If more than one assignment were given to the students, 28.9% felt stressed and 25.3% students felt challenged. Whereas 16.7% felt irritated and almost 15% felt normal or frustrated.

If the students find relevant but confusing information, 47.8% tried to find an easy one, 30.8% kept struggling to make some sense out of it. 16.4% skip that information and 13.9% think that they will come back to that information later. Only 27.5% think about taking help. If the students were collecting information on a given topic, 52.5% preferred a power point presentation, 46.1% went for easy text information and almost 40% looked for the authentic and reliable text resource. 15% of the students loved to collect the information through listening to the audio and 9.4% liked an illustrated text, whereas 92.5% did not like to consult a complicated text. Most of the students (56.4%) liked a goal free assignment, in which they can work creatively and 36.4% liked to work on an assignment given to them and they have to complete it as they want or again creativity is there. 35% students like small projects and 21.9% of the students liked an assignment where worked example is provided to them. Moreover only 20.3% students liked to do a copy and paste assignment.

Analysis of open ended questions

Some questions were given to the students so that they can answer openly. The purpose was to collect qualitative data to support the quantitative results. The question was asked about the reaction of respondents with their family, friends and teachers when facing with information overload. The qualitative data was analyzed using NVivo software, as seen in table 5.

Table 5

Respondents' reactions during information overload

No.	Respondents' reactions/feelings	Frequency
a	Reactions with family	
	Ask for help, share the problem, discuss, group study, normal, good, make fun, relaxed, friendly, more polite, enjoy.	97
	Humble, happy, spend time with them.	83
	Irritated, aggressive, frustrated, furious, quarrelsome, argumentative.	67
	Stressed, quiet, silent, confusing, spend time alone, worried.	51
	Negative, bad, cry, rude, unhappy, upset, uneasy, jealous, not friendly, not satisfied, sad, avoid, disheartens.	17
	Challenged	1
b	Reactions with friends	
	Irritated, frustrated, aggressive, quarrelsome, furious, harsh, panic, rude, hyper.	74
	Quiet, silent, not friendly, unhappy, mood off, reserved, serious, confused, avoid, not comfortable, uneasy, annoyed, blame myself, spend time alone, tense.	61

	Normal, good, happy, chilled, cheer up, fine, better, friendly, relaxed, satisfactory.	57
	Ask for help, share the problems, ask to pray, ask for guidance, discuss, encouragement, get support, feedback, ask for time, spend time with friends.	43
	Stressed, worried, depressed, can't concentrate.	27
c	Reactions with teachers	
	Ask for help, ask for guidance, ask for explanations, ask for more time, ask for encouragement, talk to the teacher, encouragement, get support, share the problem, take advice, questioning, request for no more assignments, request to change the topic, challenged.	103
	Normal, good, feel better, happy, fine, positive, collect more information, check the material, try to understand.	83
	Stressed, confused, reserved, annoyed, not feeling good, quiet, silent, avoid work, do not trust teachers, unhappy, embarrassed, afraid, could not concentrate, disappointed, sad, feeling uneasy, not comfortable, panic.	73
	Irritated, aggressive, frustrated, rude, do not trust, harsh, negative, panic.	38

Results obtained in table 5 show that in the presence of information overload most of the respondents (97) asked their families to support, help and discuss or share their problems with them. 83 of the respondents felt normal, enjoy, have fun and wanted to spend more time with them to be more relaxed and happy. They became more polite and humble with them to face the information overload, whereas 67 respondents felt extreme negative emotions like stress, becoming furious, frustration, argumentative, quarrelsome and aggression. On the other hand, 51 respondents felt stressful, confused, worried and becomes quiet, silent and wanted to spend time alone while facing information overload. 17 of the respondents complained of behaving negatively, rude, unhappy, upset, uneasy, jealous, unfriendly, unsatisfied sad, disheartens and wanted to cry.

The most of the respondents (74) showed their extreme negative reactions like frustration, irritation, aggression etc. in front of their friends when facing information overload. Whereas 61 respondents admitted that they displayed their mild negative reactions like feeling annoyed, being reserved, becoming serious, showing signs of uneasiness or sometimes avoiding their friends. While 27 respondents admitted that they felt stressed, worried, depressed more in front of their friends so that they could understand indirectly that there is some problem. Only 43 respondents asked for the direct help, support, guidance, feedback and shared their problems with their friends and wanted to spend more time with them.

When students were asked about their reactions with the teachers in the presence of information overload, 103 respondents revealed an inquiring attitude towards their teachers. They wanted to consult the teachers for their help, support, guidance, feedback, advice or sometimes go to them with a request to change the topic or to provide more time for their assignment. 83 respondents felt normal, good, better, happy, fine or positive and tried to collect more information, check the material and sometimes try to understand the problem by themselves. Whereas in the presence of information overload 73 respondents felt stressed, confused, embarrassed, annoyed and reserved. They were not feeling good, remained quiet, silent, uneasy, uncomfortable, unhappy, sad and sometimes even afraid. They were so disappointed that they could not concentrate and some tried to avoid the work. Some got panic and some did not trust their teachers that they would provide any kind of support.

Plenty of new information is being generated all the time through electronic media, computer technologies and paper printed material. Most of the respondents preferred to use technology or computer generated information material which provides visuals, illustrated text and power point presentation. They chose this medium because it provides different difficulty levels of text. If they could not understand some text because of its difficulty, confusion or irrelevancy they switched over to the other piece of information. The longer people are subjected to information overload, the more negative its effects on physical and mental well-being.

Information overload occurs when a large amount of information beyond one's capacity to process is communicated. The use of advanced features of educational technologies has provided access to a richer and more complex information environment in a variety of formats and from different types of information resources. This proliferation of information has imposed information overload on students (Kalyuga, 2011).

There are different opinions about when people first started noticing information overload. What is obvious is that attentions directed more toward information overload as a serious problem by the end of the last century. Some researchers view it as a result of our entry to a new period called "Network period". This period can be characterized by a convergence of computer technology, telecommunication technology and media technology (Bradley, 2000).

According to some students' point of view, they like to share the information with others which is a proof of strong communication and interpersonal skills and according to learning theories, it enhances learning a lot. Computer literacy was average. It didn't matter how much expertise are there but even students with average computer skills showed good performance in their CGPA. Basic knowledge of computer literacy was sufficient. Most of the students prefer goal free assignments, assignments which provided them with a start or small projects, which enable them to apply their skills, allow them to be more creative and show their productivity and at the same time helping them to manage the information overload effectively.

Conclusion and Recommendations

The purpose of the study was to know the impact of information overload on students' learning. Learning is a process not a product; Constructivist learning theory claimed it years ago. Learners' experiences, perceptions, language and community all plays a significant role in the real life context to critically think and overcome the problems independently. The findings of this study are also evident that to avoid information overload, due attention must be given to the learning processes, learning environments and the learner himself, which ultimately leads to reduced information overload and increased learning outcomes. Students' language skills and computer skills are also directly related to managing information and information overload and can contribute directly to their academic achievements. Furthermore even if someone does not possess the required language or computer skills to manage information overload, their teachers and community is a remarkable source to provide facilitation to them in attaining good academic achievement.

Research findings on creating constructivist teaching environments can be shared with administrators and teachers to increase their awareness levels and to help reduce the students' cognitive load. Before starting any educational program in any of the institute, information literacy and basic computer skills must be taught to the students to manage the information overload successfully. This study was conducted on a small sample of one institute of a single university; further research can be conducted on larger samples in different public and private institutions of the country.

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