CLASS – XI

CHAPTER - SOCIETY, LAW AND ETHICS

STUDY NOTE

Period-01

INTRODUCTION

We are now living an era called the information age where we see that most our activities are technology—influenced, be it making an online payment, creating or development of own piece of art or information (such as writing articles or clicking photographs and so forth). With the reach of technology to our day to day life, there has been a paradigm shift, and it has also raised specific issues and problems related to society, ethics and law. In this chapter, we shall talk about topics about this very domain such as intellectual property rights, plagiarism, cybercrime, cyber law, e-waste management etc.

ETHICAL ISSUES

These days, we can easily say that our society is information society and our era is information era. As we all know that information is the means to acquire knowledge. In other words, we can say that information forms the intellectual capital for a person or body. However, there are many ethical issues involved with the usage and availability of information.

Some common ethical issues are:

(i) Intellectual property rights

(ii) Plagiarism

(iii) Digital property rights

Intellectual Property Rights

As mentioned earlier, information makes intellectual property. Any piece of information is produced or created with a lot of efforts and it consumes a lot of time. The cost factor is also involved with the creation or production of information. Though once produced, it becomes very easy to duplicate it or share it with others. But this very thing makes information difficult to safeguard unlike tangible property.

The creator/producer of the information is the real owner of the information. And the owner has every right to protect his/her intellectual property. To protect one's intellectual property rights one can get information **copyrighted or patented** or use trademarks. Let us talk about what these terms mean.

	Copyright	Patents	Trademark
What is it?	A copyright is a legal term to describe the rights of the creator of an original creative work such as a literary work, an artistic	A patent refers to a collection of exclusive rights given to the inventor for their invention(s).	Trademarks are some registered words, slogans logos, shapes, colours and sounds etc. used to distinguish the goods

	work, a design, song, movie or software etc.		or services one trader from another.
What's Protected ?	Original works of authorship, such as books, articles, songs, photographs, sculptures, choreography, sound recordings, motion pictures, and other works.	Inventions, such as processes, machines, manufactures, compositions of matter as well as improvements to these.	Any word, phrase, symbol. and/or design that identifies and distinguishes the source of the goods of one party from those of others.
Requirements to be Protected	A work must be original, creative and fixed in a tangible medium.	An invention must be new, useful and non-obvious.	A mark must be distinctive (i.e., that is, it must be capable of identifying the source : 7 particular good).
Term of Protection	Author's life plus 60 more years in India.	20 years	For as long as the ma-l. used in commerce.
Right Granted	Right to control the reproduction, making of derivative works, distribution and public performance and display of the copyrighted works.	Right to prevent others from making, selling, using or importing the patented invention.	Right to use the mark arid ail prevent others from use similar marks in a way that would cause likelihood-of confusion about the origin of the goods or services.

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The ethical issue involved with it is that information must not be exchanged consent of its owner. The intellectual property rights must be protected, for it :

- encourages individuals and businesses to create new software and new software applications, as well as improving existing applications,
- ensures new ideas and technologies are widely distributed
- promotes investment in the national economy.

A Violation of IPR

People, companies violate the intellectual property right -(IPR) in many ways. The violation of IPR (Intellectual Property Rights) is called **infringement** or **1PR infringement.**

There are three forms of IPR infringement:

(i) Plagiarism
(ii) Copyright infringement
(iii) Trademark infringement

I. Plagiarism

Simply put, Plagiarism means stealing. Surprised? If you look into an English dictionary to find the meaning of word plagiarism, it will give somewhat like "the unauthorized use or close imitation of the language and thoughts of another author and the representation of them as one's own original work."

Thus, Plagiarism is stealing someone else's intellectual work (can be an idea, literary work or academic work etc.) and representing it as your own work without giving credit to creator or without citing the source of information.

Any of the following acts would be termed as Plagiarism:

- Using some other author's work without giving credit to the author.
- Using someone else's work in incorrect form than intended originally by the author/creator.
- Modifying/lifting someone's production such as music-composition etc. without attributing it to the creator of the work.
- Giving incorrect or incorrect source of information i.e., wrongful citation.
- Failure in giving credit or acknowledging the contribution of others in a collaborative effort, to which you are also part of.

How not to Plagiarize?

As most universities I put in their student-handbook. 'To avoid plagiarism

You must give credit whenever you use

- another person's idea, opinion, or theory;
- quotations of another person's actual spoken or written words; or
- Paraphrase of another person's spoken or written words.

Plagiarism is Offence

'If plagiarism involves copying not only ideas but also a substantial portion of a copyrighted work without attribution and without permission, it would amount to both copyright infringement and the violation of the 'special right' of the author to be credited.

Copyright infringement and the violation of an author's right to be credited are both civil wrongs and criminal offences. A civil suit may be instituted, and criminal charges may also be filed.

Both civil suit and criminal charges are punishable offences and amount to fine and penalties.

II. Copyright Infringement

A copyright infringement refers to using copyrighted work without the consent or permission of the copyright holder. The infringement of intellectual property occurs when an individual or group of individuals fabricate copywriters' work intentionally or unintentionally without giving them credit. For instance, if you use an image or a video available online, without asking

1. Found in most universities' guidelines for students/ student-handbooks

2.www.mxmindia.com (interview of Nandita Saikia)

for permission, it may be copyright infringement because not everything which is available on the Internet is available for free use. Most of the things available online are copyright protected.

Other examples of copyright infringement include:

- Selling pirated books
- Selling copied/duplicated art work
- Selling pirated software
- Performing a play in public without obtaining permission from the play right
- Online piracy and many other such acts.

III. Trademark Infringement

The trademark infringement is the unauthorised usage of a mark that is identical or deceptively similar to a registered trademark. The term deceptively similar here means that when an average consumer looks at the mark, it is likely to confuse him/her of the origin of the goods or services.

All types of IPR infringements are crimes and the owner can initiate a legal action against people/companies who do it.

Digital Property Rights

Digital property (or digital assets) refers to any information about you or created by you that exists in digital form, either online or on an electronic storage device. All of your digital property comprises what is known as your digital estate.

Examples of digital property include : any online personal accounts, such as email ma communications accounts, social media accounts, shopping accounts, photo and video sharing as video gaming accounts, online storage accounts, and websites and blogs that you may manage ; dolma names registered in your name ; intellectual property, including copyrighted materials, trademarks patents and any software or code (such as software tools created by you or games or apps created by you may have written and own etc.

Digital property rights lie with the owner. Legally a person who has created it or the Gamer who has got it developed by paying legally is the legal owner of a digital property. Only owner can use and decide who all and in what form can his/her digital asset may be used bur other, whether by making payments or by buying it or by obtaining its license or usage etc. But this is not the case generally; there are many threats to digital properties.

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Threats to Digital Properties

Let us briefly talk about common threats to digital properties:

1. Digital software penetration tools. Although one needs to buy usage rights or license to use a digital property, there are many software penetration tools such as cracks and keygens, tools created by hackers to penetrate your software's registration gym are enable unauthorized users to freely access your software without actually paying for it.

2. Stealing and plagiarizing codes of your digital properties. Sometimes other developers somehow get hold of your software's source code and then create plagiarized versions of your code and use it in their own software. In other words, they steal your software's source code and use it to build their own versions of it, and then sell it under their own company name.

Digital Property Rights Protection

As there are multiple types of threats to digital properties, there are many ways you can ensure protection of your digital properties. Let us talk about these protective measures:

1. Anti-Temper Solutions. There are many anti-tamper solution available today which ensure that your digital property is tamper-proof. These anti-temper solutions use a host of advanced technologies to prevent hackers from hacking, reverse-engineering or manipulating your digital properties such as utility tools, software, apps, video games and so forth.
2. Legal Clauses. Add legal clause in the clauses of use of your software/digital properties. You must include a transparent clause in your software's Terms of Service that prohibits the scraping of your software's source code for reuse. This is a sound legal backup for you.
3. Limit the sharing of software code. You should share your software code only with trusted individuals who are part of development team. You should also use a Digital Rights Management (DRM) solution to protect your software from being scraped for source code using decompilers etc.

Period-02

OPEN SOURCE PHILOSOPHY AND SOFTWARE LICENCES

Broadly the term 'open source software' is used to refer to those categories of software / programs whose licenses do not impose much conditions. Such software, generally, give users freedom to run/use the software for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program (without having to pay royalties to previous developers).

There are many categories of software that may be referred to as open source software. Following subsection is going to talk about the same.

Terminology

Before we talk about various terms and definitions pertaining to 'Open' world, you must be clear about two terms which are often misunderstood or misinterpreted.

These terms are :

- Free software and
- Open source software

Free Software

Free Software means the software is freely accessible and can be freely used, changed, improved, copied and distributed by all who wish to do so. And no payments are needed to be made for free software.

The definition of Free Software is published by Richard Stallman's Free Software Foundation. Here is the key text[3] of that definition :

"Free software" is a matter of liberty, not price. To understand the concept, you should think of "free" as in "free speech," not as in "free beer." Free software is a matter of the users' freedom

to run, copy, distribute, study, change and improve the software. More precisely, it refers to four kinds of freedom, for the users of the software :

- The freedom to run the program, for any purpose (freedom C).
- The freedom to study how the program works, and adapt it to your needs (freedom _V. Access to the source code is a precondition for this.
- The freedom to redistribute copies so you can help your neighbor (freedom 2).
- The freedom to improve the program, and release your improvements to the public, so that the whole community benefits (freedom J. Access to the source code is a precondition for this.

A program is free software if users have all of these freedoms.

Open Source Software

Open Source Software Open Source Software, on the other hand, can be freely used (in terms of making modifications constructing business models around the software and so on) but it does not have to be free of charge. Here the company constructing the business models around open source software may receive payments concerning support, further development. What is important to know here is that in open source software, the source code is freely available to the customer.

Philosophy of Open Source

Open source software is officially defined by the open source definition at http://www.opensource.org/docsidefinition_plain.html.

It states that :

Open source doesn't just mean access to the source code. The distribution terms of open-source software must comply with the following criteria :

Free Redistribution	No restriction on the re-distribution of the software whether as a whole or part.
Source Code	The program must include source code, and must allow distribu:-. _- source code as well as compiled form.
Derived Works	The license must allow modifications and derived works, and must allow to be distributed under the same terms as the license of the original software.
Integrity of the Author's Source Code	The integrity of the author'source code must be maintained. Any additions/modifications should carry a different name or version number from lie original software.
No Discrimination Against Persons or Groups	The license must not discriminate against any person or group of persons.
No Discrimination Against Fields of Endeavor	The license must not restrict anyone from making use of the program in a specific field of endeavour. For example, it may not restrict the program from being used in a business, or from being used for genetic research.

Distribution of License	The rights attached to the program must apply to all to whom the program is redistributed.
License must not be Specific to a Product	There must not be any restriction on the rights attached to the program, i.e., there should not be a condition on the program's being part of a particular software distribution.
The License must not Restrict other Software	The license must not place restrictions on other software that is distributed along with the licensed software. For example, the license must not insist that all other programs distributed on the same medium must be open-source software.
Licence must be Technology Neutral	No provision of the license may be predicated on any individual technology or style of interface.

A software which is free as well as open belongs to category FOSS (Free and Open Source Software).

Definitions

After understanding the difference between the terms free and open, let us now proceed to our discussion on terminology and definitions pertaining to open source software.

OSS and FLOSS	OSS refers to open source software, which refers to software whose source code is available to customers and it can be modified and redistributed without any limitation. An OSS may come free of cost or with a payment of nominal charges that its developers may charge in the name of development, support of software. FLOSS refers to Free Libre and Open Source Software or to Free Livre and Open Source Software. The term FLOSS is used to refer to a software which is both free software as well as open source software. Here the words libre (a Spanish word) and livre (a Portuguese word) mean freedom.
GNU.	GNU' refers to GNU's Not Unix. GNU Project emphasizes on freedom. The GNU project was initiated by Richard M. Stallman with an objective to create an operating system. With time, GNU project expanded and now it is not limited to only an operating system. Now, it offers a wide range of software, including applications apart from operating system.
FSF	FSF is Free Software Foundation. FSF is a non-profit organization created for the purpose of supporting free software movement. Richard Stallman founded FSF in 1985 to support GNU project and GNU licences. Now a days, it also works on legal and structural issues for the free software community.
OSI	OSI is Open Source Initiative. It is an organization dedicated to cause of promoting open source software. Bruce Perens and Erics Raymond were the founders of OSI, that was founded in February 1998. OSI specifies the criteria for open source software and properly defines the terms and specifications of open source software. Open source doesn't just mean access to the source code. The distribution terms of open source software must comply with the Open Source Definition by OSI.

Freeware	The term freeware is generally used for software, which is available free of cost and which allows copying and further distribution, but not modification and whose source code is not available. Freeware should not be mistaken for open software or for free software. Freeware is distributed in binary form (ready to run) without any licensing fee. In some instances the right to use the software is limited to certain types of users, for instance, for private and non-commercial purposes. One example is Microsoft Internet Explorer, which is made available as freeware.
W3C	W3C is acronym for World Wide Web Consortium. W3C is responsible for producing the software standards for world wide web. The W3C was created in October 1994, to lead the world wide web to its full potential by developing common protocols that promote its evolution and ensure its interoperability. The World Wide Web Consortium (W3C) describes itself as follows : The World Wide Web Consortium exists to realize the full potential of the Web. The W3C is an industry consortium that seeks to promote standards for the evolution of the Web and interoperability between WWW products by producing specifications and reference software. Although industrial members fund W3C, it is vendor-neutral, and its products are freely available to all.
Proprietary software	Proprietary software is the software that is neither open nor freely available. Its use is regulated and further distribution and modification is either forbidden or requires special permission by the supplier or vendor. Source code of proprietary software is normally not available.
Shareware	Shareware is software, which is made available with the right to redistribute copies, but it is stipulated that if one intends to use the software, often after a certain period of time, then a license fee should be paid. Shareware is not the same thing as free and open source software (FOSS) for two main reasons: (i) the source code is not available and, (ii) modifications to the software are not allowed. The objective of shareware is to make the software available to try for as many users as possible. This is done in order to increase prospective users' will to pay for the software. The software is distributed in binary form and often includes a built-in timed mechanism, which usually limits functionality after a trial period of usually one to three months.
Copylefted software	Copylefted software is free software whose distribution terms ensure that all copies of all versions carry more or less the same distribution terms. This means, for instance, that copyleft licenses generally disallow others to add additional requirements to the software) and require making source code available. This shields the program, and its modified versions, from some of the common ways of making a program proprietary.

Licenses and Domains of Open Source Technology

As per Open Source Initiative, "Open source licenses are licenses that comply with the Open Source Definition — in brief, they allow software to be freely used, modified, and shared." Open-source licenses make it easy for others to contribute to a project without having to seek special

permission. It also protects you as the original creator, making sure you at least get some credit for your contributions. It also helps to prevent others from claiming your work as their own.

Broadly used open source licences are being given below for your reference :

1. Creative Commons Licenses (CC licenses)

CC licences, issued by Creative Commons organisation (non-profit organisation), allow the creator of the work to select how they want others to use the work. When a creator releases their work under a CC licence, people only need to seek the creator's permission when they want to use the work in a way not permitted by the licence.

Standard rights and obligations of CC licenses. CC provides six core licences, each of which allow members of the pubic to use the material in different ways, but each of them include certain standard rights and obligations as listed below:

User Rights	User Obligations
Copy the work (e.g., download, upload, photocopy and scan the work) ;	Always attribute the creator of the work;
Distribute the work (e.g., share copies of the work);	Get permission from the creator to do anything that goes beyond the terms of the licence (e.g., making a commercial use of the work);
Display or perform the work (e.g.,. play a sound recording or film in class, or stage a play to parents);	Keep any copyright notice attached to the work intact on all copies of the work;
Communicate the work (e.g., make the work available online on the school intranet, learning management system or on a class blog); and	Indicate and link to the licence from any copies of the work; and
Format shift verbatim copies of the work (e.g., copy a MP3 version of music onto a CD or an MP4 version of a film onto a DVD to play in class).	Whenever you make changes to the work, acknowledge the original work and indicate that changes have been made (e.g., by stating 'This is a Hindi translation of the original work, X').

2. GNU General Public License (GPL)

The GNU General Public Licence (GPL) is probably one of the most commonly used licenses for open-source projects. The GPL grants and guarantees a wide range of rights to developers who work on open-source projects. Basically, it allows users to legally copy, distribute and modify software. This means, with GPL, a user can :

Copy the software	Copy the software as many times as needed. There's no limit to the number of copies one can make.
Distribute the	There is no restriction of distribution methods and styles — can be in however you want copied form or printed form or web-link form.

Software however you want	
Charge a fee to distribute the software	After modifying the software, you can even charge for your software, distribute the software explaining why you are charging them but the software should still be under GNU GPL.
Make whatever modifications to the software you want	You are free to make any kind of modifications to the GNU GPL modifications to the software. The only catch is that the other project must also be released software you want under the GPL.

3. Apache License

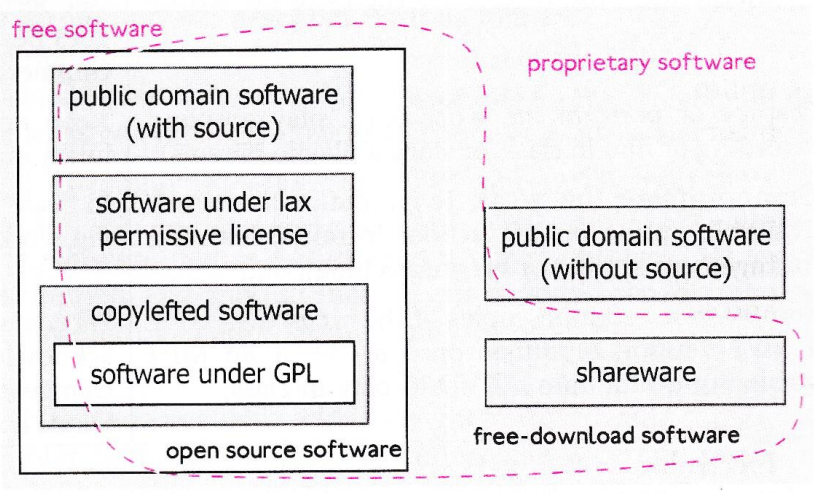
The Apache License, grants a number of rights to users. These rights can be applied to both copyrights and patents. The Apache License offers :

Rights are perpetual	Once granted, you can continue to use them forever.
Rights are worldwide	If the rights are granted in one country, then they're granted in all countries.
Rights are granted for no fee or royality	There is up-front usage fee, no per-usage fee or any other basis fee or royalty. either.
Rights are non-exclusive	You are not the sole-licensee; other can also use the licensed work.
Rights are irrevocable	No one can take these rights away once they're granted

Redistributing code requires giving proper credit to contributors to the code and the same license (Apache) would remain with the software extension.

Public Domain Software vs. Proprietary Software

Public-domain software is free and can be used without restrictions. The term public-domain software is often used incorrectly to include freeware, free software that is nevertheless copyrighted. Public domain software is, by its very free software nature, outside the scope of copyright and licensing. On the contrary, there is 4 Proprietary software, which is neither free nor available for public. There is a proper license attached to it. User has to buy the licence in order to use it. Consider the diagram (Fig. 17.1) originally made by Chao-Kue? that describes the categories of software.



Figre 17.1 Categories and domains of software.

Period-03

TECHNOLOGY AND SOCIETY

ICTs are general purpose technologies, i.e. technologies whose value and impact arise primarily from their use in other economic and social sectors. Three capabilities are especially important for economic and social development.

ICTs:

- enable greater efficiency in economic and social processes ;
- enhance the effectiveness of cooperation between different stakeholders ; and
- increase the volume and range of information available to people, businesses and governments.

Systemic impacts which ICTs have had on the development of economies, societies and culture, include:

Economic Impacts include the globalisation of production in goods and services, changes in international trade and distribution networks, changes in patterns of consumption, the virtualisation of some products and behaviours, and the growing importance of the ICT sector within the world and national economies.

Social Impacts include mass market access to an enormously increased range of information resources, enhanced freedom of expression and association, new patterns of work and human settlement, changes in the relationships between government, citizen and the state, and between citizens, and associated challenges to traditional ideas of privacy and individuality.

Economic Benefits

The impact of ICT on the economic sector has a positive multiplier effect on the Business World. Some major benefits include :

1. Secure Transactions. Banks and similar institutions could be said to be the sector that have benefited the most from latest developments in ICT. Fund transfer can now be made in a matter of seconds within a locality and to the most parts of the world with a greater security than ever.

2. Ease and Availability. One doesn't need to stand in long queues for fund withdrawal ; with the use of the ATM Card and Internet banking, the banking transactions can be carried out at any time of the day within the scope of transactions allowed. Such transactions could even include payment of bills such as electricity, water rates etc.

3. Net Banking. With online or Internet banking a lots of payments and buying can be done online via one's bank account at the convenience of one's home or Office. The life wire of any business is fund availability and its timeliness and net banking ensures both.

4. Global Market. With ICT, now the market is entire globe. A small business in a small town can think of reaching to a buyer in any part of the world. And buyer's access is not just limited to his own market, (s)he can now have access to the all world market, courtesy Internet and ICT.

Period-04

E-WASTE MANAGEMENT

Electronic waste, e-Waste, e-Scrap, or **Waste Electrical and Electronic Equipment** (WEEE) describes discarded electrical or electronic devices. "Electronic waste" may also be defined as discarded computers, office electronic equipment, entertainment device electronics, mobile phones, television sets and refrigerators. This includes used electronics which are destined for reuse, resale, salvage, recycling, or disposal.

Of all the different types of waste, electronic waste has the characteristics of : *(a)* the fastest growing segment of waste *(b)* most valuable due to its basic composition *(c)* very hazardous if not handled carefully.

Important Concern of Discarding e-Waste

While discarding e-waste, you should be careful about the data stored in discarded storage devices. It is very important that you delete everything stored in them manually, permanently, be it your computer systems' hard disc, laptop's disk, smartphone's memory disks, digital camera's storage and so forth. Just deleting the digital data is not enough, someone can still undelete it. So, take care to format it or delete it using proper tools that shred the data in a form which can never be undeleted or unformatted later.

E-Waste Disposal Process

E-Waste is categorized by the government of India under the broad class of hazardous waste. Within e-Waste, there are several categories such as Large and small household appliances, electrical and electronic toys and sporting equipment, tools, computers and related equipment and so forth.

Composition of e-waste. Electrical and Electronic equipment contains metallic and non metallic elements, alloys and compounds such as Copper, Aluminum, Gold, Silver, Palladium, Platinum, Nickel, Tin, Lead, Iron, Sulphur, Phosphorous, Arsenic etc.

The E-waste management involves proper recycling and recovery of the disposed material. The recycle and recovery includes the following unit operations.

1. **Dismantling.** Removal of parts containing dangerous substances (CFCs, Hg switches, PCB); removal of easily accessible parts containing valuable

substances (cable containing copper, steel, iron, precious, metal containing parts).

2. **Segregation of ferrous metal, non-ferrous metal and plastic.** This separation is normally done in a shredder process.
3. **Refurbishment and reuse.** Refurbishment and reuse of e-waste has potential for those used electrical and electronic equipments which can be easily refurbished to put to its original use.
4. **Recycling/recovery of valuable materials.** Ferrous metals in electrical are furnaces, non-ferrous metals in smelting plants, precious metals in separating works.
5. **Treatment/disposal of dangerous materials and waste.** Shredder light fraction is disposed off in landfill sites or sometimes incinerated (expensive), chlorofluoro-carbons (CFCs) are treated thermally, Printed Circuit Board(PCB) is incinerated or disposed off in underground storages, Mercury(Hg) is often recycled or disposed off in underground landfill sites.

Benefits of e-Waste Recycling

The e-Waste disposal and proper recycling is very much necessary and important for the benefit of people , environment and the nation. The key benefits are :

1. **Allows for recovery of valuable precious metals.** Most consumer electronics contain valuable materials like copper, gold and zinc that can and should be recycled. Virgin Materials are significantly more costly than recycled materials for manufacturing.
2. **Protects public health and water quality.** E-waste contains a variety of toxic substances, which may include lead, mercury and cadmium. When e-waste is disposed into landfills, these toxins can be released into the atmosphere or leak in through the land and have negative health and environmental effects.
3. **Creates Jobs.** Recycling e-waste domestically creates jobs for professional recyclers and refurbishers and creates new markets for the valuable components that are dismantled.
4. **Toxic Waste.** Mining produces toxic waste, which are linked with crop devastation and human health crisis due to water contamination
5. **Saves landfill space.** E-waste is a growing waste stream. Recycling these items will help conserve landfill space.

Period-05

GENDER ISSUES WHILE TEACHING/USING COMPUTERS

The subject 'computers' is introduced in primary classes in most of the schools, 'Computer Science' as a major subject gets introduced only in high school. While teaching computers, there are many gender specific issues that must be addressed to enforce gender equity in computer science education. Let us talk about these issues.

Gender Issues

Gurvinder and *Bela* are Computer Science teachers at two different co-educational schools. Both said that in the class of the subject 'Computer Science', 60-70 %[6] are boys and rest are girls. This trend *i.e.,* more boys opt for 'Computer Science' than girls, has been continuing for years now. So *'under representation'* of girls is one major issue.

There are some other issues as well. Let us discuss some major gender issues at school-lev Computer Science education.

1. Under Representation

In India, this has been commonly observed over cities that girls are under represented in 'Computer Science' studies be it 'Computer Science' major subject at high school or 'Computer Science major' at college level. There are far less girls than boys in a computer science section.

A leading engineering institution of India has reported that there has been about 17% of girls represented in 'Computer Science' engineering in recent years.

There are many factors that are attributed as the reasons behind this. These are :

(i) Preconceived Notions. There are many preconceived notions prevalent that subconciously play a role. Notions like *'boys are better at technical things, girls are good at humanities, arts etc.'; 'girls must take up a career keeping in mind that they have to raise a family. They must not take up high involvement careers',* and *`Teaching is the best option for girls as it gives you half day off and ample number of holidays so that you can easily take care of your family',* etc. have their impact in decision making of girls while taking up subjects. Also, in India, parents play an important role while deciding about subjects and parents directly/indirectly push these pre-conceived notions influencing girls' decisions and girls end up taking other subjects than 'Computer Science'.

(ii) Lack of Interest. During primitive years, children often play games on computers/ smartphones. Most games available today are boys-centric that increase their interest in computers. Also, at homes boys get to play more on computers/smartphone (keeping in mind the entire India scenario) and develop more interest in computers than girls.

(iii) Lack of Motivation. Girls are pressurised to choose a career option which will give them 'work life balance' in favour of family roles they have to play later on. Girls are always told directly/indirectly in households that you have to play important family role later on and indulging in a subject which will consume most of your time is not advisable as no matter what, whatever job option you choose, you cannot shy away from your family role. This

'double burden' theory also discourages girls from taking up technical subjects like Computer Science.'

(iv) Lack of Role Models. Girls these days see less of role models in the field of 'Computer Science' whom they can imitate. TV, movies, advertisements, every where it is portrayed that is technical fields like 'Computers Science', are men's fields. If you see a woman scientist in a team, there are 10 other scientists who are males, in a movie/advertisement etc. what would you think sub-consciously. All these things influence girls sub-psychologically and they infer that 'Computer Science' is for boys and do not take up the subject.

(v) Lack of Encouragement in class. As there are lesser number of girls in a class, the teachers for most work-assignments end up choosing more boys. Also, less number of girls means, lesser peer-encouragement. Also, some teachers pin point on their roles in society such 'girls will get married and may not take it up as career'. All this may play as a hindrance and girls do not develop as much interest as they can in 'Computer Science' subjects.

2. Not Girl-Friendly Work-Culture

It has been observed that when, in schools, work-partners are chosen, boys prefer boys over girls. And even if a girl and a boy are made work-partners, boys prefer to work actively and make girls silent observers. Boys are not comfortable in situations where they are not playing active roles.

Even if girls are given separate computers to work on, they are very shy of working actively. As per a study, the problems mentioned by girls in a computer room are like : 'insufficient access time', 'difficulty with maintenance' or 'insufficient peripherals available' etc. contrary to problems mentioned by boys such as 'software not usable', 'limitations of software', 'poor quality of help' etc.

Possible Solutions

The issues listed above are not intentionally created, hence they need a different type of handling.

(i) There should be more initiatives and programmes that encourage girls to take up Computer Science subject. Presently there are many initiatives supported by government and run by many tech-giants to encourage more girls to take up 'Computer Science' subject.

(ii) The Film and TV censor board should ensure fair representation of female role models in TV, cinema etc. so that more girls get encouraged to take up 'Computer Science'.

(iii) In the practical rooms, girls should be encouraged more to work on computers on their own and also to find solutions of their routine problems such as

'peripheral not available'. They should assertively speak to the lab attendant to get all the peripheral devices they want. They should be encouraged to celebrate small success in the lab (such as a bug successfully removed) to big success (such as project working superbly). This will instill more confidence and more interest in girls to work with 'Computer Science' subject.

Period-06

DISABILITY ISSUES WHILE TEACHING AND USING COMPUTERS

Increased focus on 'inclusive education' and promoting access for students with disabilities and impairments, in the field of technology and computer science have made today's classroom really diverse and inclusive. While at one end, it has positively aided to the cause of 'inclusive education' ; on the other side, there are many issues that have risen and those must to taken care of in order to impart real education.

In the specially abled students, there can be one or more disabilities :

(i) **Locomotor disabilities.** Severe deformities, polio, leprosy, cerebral palsy.

(ii) **Hearing and speech disabilities.** Hearing impairment, speech aphasia.

(iii) **Cognitive impairment.** Specific learning deficits (Dyslexia, Dyscalculia), Down's syndrome, Autism.

(iv) **Vision impairment.** low vision, blindness.

Various disability issues faced in the teaching/using computers with regard to above disabilities are being discussed below.

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1. Unavailability of Teaching Materials/Aids

Students with different disabilities need different types of teaching aids/materials. For instance, visually challenged students would want that there are screen readers that could read the digital content to them ; also programming lessons should not involve visual inputs *(e.g.,* in classes 9-10 there are two alternatives for programming concepts : Python for visually impaired students and Scratch for others).

Similarly, hearing impaired students would want more of visual input than oratory, rather oratory instructions should be available in sign language if possible.

A lot of children, not all, with locomotor disabilities are both keyboard disabled and mouse disabled; however, they can use virtual keyboards for writing computer programs. For virtual keyboards supporting such students, following types of hardware are required :

1. Sophisticated virtual keyboard software.
2. A joystick that is specific to the needs of the child.

3. A programming editor that can be interfaced with the virtual keyboard, and does not require any mouse movements.

For low-vison students, **Braille keyboards, Braille monitors,** and **Braille printers** along with **screen readers** should be made available to facilitate their learning and working on computers.

Unavailability of such supportive programming aids and software are a big issue that must be handled by schools and their managements.

2. Lack of Special Needs Teachers

For different types of special needs, if special needs teachers are available, disabled students get their needs addressed in right manner *e.g.,* for hearing impaired students, a teacher who is able to converse in sign language would be able to convey and explain the study material than traditional methods.

There should be teachers who know what types of hardware, software, tools etc. can be used for the differently able students as per their specific needs, *e.g.,* special types of specialized hardware such as *Braille keyboards, monitors, printers, synthetic speech generators* etc., software assistants such as *Google assistant* etc.

There are many types of software features and voice assistants that visually impaired students can use, *e.g.,*

- Microsoft's *Narrator* and *Cortana* and Ubuntu's *Orca* and *onBoard,* the voice assistants which blind people can use for a variety of essential tasks.
- A special version of Linux called **BLinux** especially meant for the blind.
- host of accessibility features of various Office software that can be easily activated. These features are present in both Microsoft Office and open source offerings such as Apache OpenOffice and LibreOffice.
- Specialized editor for visually impaired students for typing programs.

3. Lack of Supporting Curriculum

Curriculum should be designed while keeping focus on inclusive education. There always should be possible alternatives keeping in mind special needs of the students. Software and programs should be so used so that the disabled students can easily work on that. For example, office software based curriculum can easily be implemented for all types of students as nearly all office software provide accessibility features.

Similarly, a programming language that requires manual code typing, such as Python, can also be used for teaching programming as long as specialized editors are also available, but Scratch, the block based programming language should not be used as it lacks accessibility features.

Further, the computer science contents and programming contests should be so conducted so that all types of students can participate in them, inclusively.

Possible Solutions

Possible solutions for the disability issues are straight forward :

- Schools must work toward making available the required teaching aids/materials to fulfill special needs of students with disabilities. There should be proper budget allocated for buying the required material and equipment to promote inclusive education.
- School must employ special needs teachers and should also train other teachers as well about how to interact with students with special needs so as to help them learn in a better inclusive way. There should be special budget allocated for training the staff about such needs.
- Schools must support the inclusive curriculum and refrain from any other practice that directly or indirectly puts the disabled students at the disadvantaged side.

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