IT user competence

Lecture Notes 1 for INF4280 – development of IT competence in organisations.

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"Competence" broadly denotes abilities related to work, while "knowledge" does not signify any particular aim of application. Since this course is about abilities for using computers, "competence" will be preferred as the basic concept, bearing in mind that computers are used also outside of work, so the interest here is competence for some activity, rather than competence for participating in working life.

Subject matter areas

Competence for using comptuers tells us what the competence is for, but not what it is about. Although is is obvious that computers constitute at least a part of what the competence is about, we will see that there are more subject matter areas of computer competence also.

Bikes are vehicles of transport on the road, and in order to ride one, you need to become familiar with two subject matter areas. First, you need to know how the technology operates, at least to the point of knowing which way to push the pedals in order to move and how to operate the brakes and the gear shift. Second, you need to know how to get along in traffic and get where you want without becoming hit and without hurting others. The technology itself and how to use its functionality in the task of your practice constitute the two subject matter areas which are needed for bike competence. Car driving has the same subject matter areas, and the driving schools have normally catered for this by dividing their curriculum into technical and traffic parts.

Bikes and cars transform energy (muscular or combustion) into another one (movement), like most of your kitchen utensils, while the primary function of clothing technology is to prevent diffusion of energy. Computers differ from these types, in that they have been developed for symbol processing, and the symbols are about a domain, eg, the numbers in a spreadsheet may represent the purchase of goods. Competent users should therefore know the relations between the domain and its representation, e.g., in order to reshape it or to spot misrepresentations. Computer users therefore need competence in three subject matter areas:

- representation of the domain
- technology
- tasks

This three-partitioning corresponds to what is found in modern information systems development methods. The functionality in users' practice is modelled by use cases, the domain in a class model, and the technology by a handful of other formal models. In general, the subject matter areas requiring user competence therefore consists of the software, the domain and the work tasks. Similar three-partitioning are found in some recent studies of IT competence. In a study of a health information system, Sahay and Molla (2007) identified three competence areas, technical, public health, and implementation and use context. Similarly, Galimoto et.al. (2008) pointed out the technology, the domain, and the management practice as the three competence areas for a management information system.

Example 1 – Bank account

Competence on representation of the domain. The domain consists of the user's account and the transfers to and from this account. The representation of a transfer would contain a date, an id, the id of the sender or receiver, an amount, etc. When paying, the user needs to know that the receiver receiver id corresponds to the one intended.

Technological competence. The competent user will know that there is a computer in the bank, possibly extended to a web browser, a card payment terminal or an ATM, where the account can be accessed, and the operations which you can apply.

Task competence. The system supports the paying and the get-cash tasks of your practice, and you need to know when you should pay someone and how much cash which is appropriate to withdraw.

Example 2 – Health information system

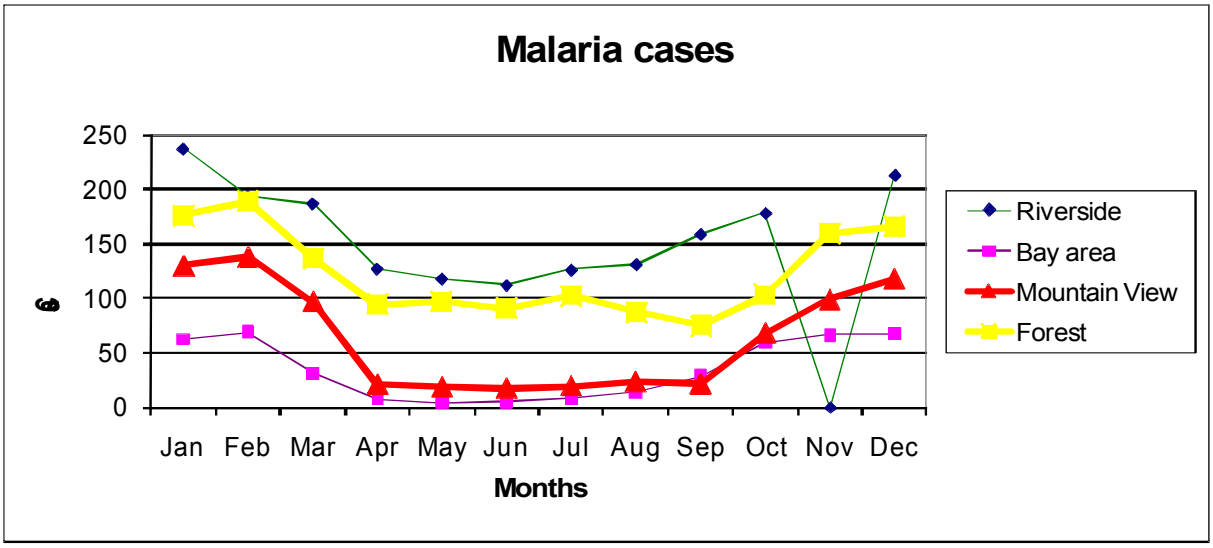

Illustration 1: Representation of a domain

Competence on representation of the domain. A health information system contains data about health activities, e.g., the number of babies immunized last month or the number of malaria cases treated. These numbers represent the domain, being the health of the population in the area. Health competence includes, e.g., that the health of a population may vary seasonally, but may not change dramatically from one year to another unless war or natural disaster. The representation of malaria shown for four areas in Illustration 1 shows a normal seasonal variation, except that a competent health professional will notice that the figure for November, Riverside is an incorrect representation of the domain.

Technological competence. The numbers can be stored in a computer system, e.g. a spreadsheet, so the user needs to have the skills to enter numbers, navigate and generate graphs like the one above. Also, knowing that the graph is updated when a number is changed in the table is useful competence when working with spreadsheets.

Task competence. The systems are used in health management, planning and monitoring, e.g., to consider whether to spray ponds in the area with chemicals in order to stop mosquitos from breeding. Health managers need to know how to utilize the data in their planning.

Illustration 2 Shows the three areas of competence whch computer users need to master.

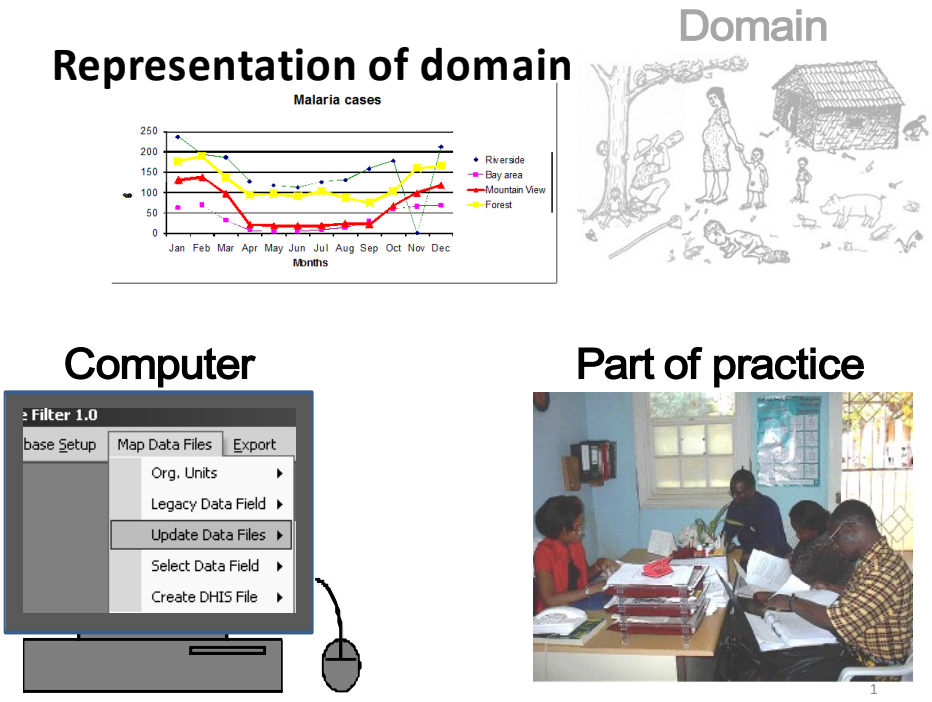

Illustration 2: The three areas of competence for computer users

Example 3 – e-mail

Competence on representation of the domain. The data in one of the messages in your mailboxes represents a sender, receivers, a subject and a body. The senders and receivers are entities of a particular type, represented by data with the particular format localpart@hostname. Knowing how the addresses are constructed may enable a successful guess of an unknown address to a known person. The subject and body represent the contents which the sender wanted the receiver to get. Knowing that a subject "Email Award Notification Of Euro 750,000" means that someone wants to tap into your bank account is also part of the useful competence of e-mail contents.

Technological competence. Knowing how to view incoming messages, and composing new messages constitute a basic technological competence on e-mailing. More advanced competence involve mailboxes and their structure, moving messages, filtering, storage of addresses, remote servers and local mailboxes, etc.

Task competence. Communication is the main task. Knowing advantages of e-mail make you prefer it when sending the same, large message to many people, and avoid it when negotiating a delicate matter within a small group. However, e-mail is also exploited for non-communicative tasks like making a backup of your file by e-mailing it to yourself and leaving the attachment on the mail-server.

Competence for learning

Information technology is characterised by a quick turnover of new software versions, information systems and hardware gadgets. Users therefore need to upgrade their competence often, so they need to constantly learn about the technology and probably also about the two other subject matter areas described above. This implies that IT user competence also includes the competence for learning about IT, which includes learning about representations of the domain, learning about the technology, and learning about tasks.

Research literature points to certain principles for learning (Bransford et al, 2000):

People learn skills through trial and error, or eventually success (p.6-8) and Learning oriented students like new challenges, while performance oriented students are more worried about making mistakes (p.61)

This distinction is well known amongst computer users. The learning oriented users actively explore the technology, trying to find better ways of using a program for a certain task, and play around with it in order to see what it can do. This is a strong learning competence. The active explorers have a tendency to become local champion, whom others ask for help and who push for new computer applications.

The performance oriented users stick with one way of using a program when they have learnt that way, even though there might be easier ways. They refrain from pushing a button which they have not touched before, due to being anxious for making a mistake of loosing data. The anxiety can be regarded as a negative computer learning competence.

A person may be performance oriented in one aspect of life, while learning oriented in another. The stereotypical image of a computer nerd is that he has learnt everything about the computer, but socially, he sticks to what he knows, which is chatting with other nerds. Likewise, the elderly social worker is fabulous in dealing with people, but she has computer paranoia.

What we learn is based on what we already know (p.10, 15-16, 68-71)

Computer users learning a new piece of software bring their experience of doing the tasks without computers and with other software. Knowing that text can be duplicated through a copier, they might type their text in the text processor, print it, multiply it in a copier machine and send one copy to each receiver. After having also learnt about electronic mail, they might reconsider this way of distributing text.

Novice users learning to use a text processor may have been used to creating one long sequence of text from page to page, and they have read newpapers where the text is divided into columns. If they get the task of organising text into two columns like in the newpaper, they may choose inserting a table with one row and two columns, since this gives the same appearance, even though they manually have to move text from one column to the next one.

Users come with blurred concepts which do not match the principles of the software package, or they have developed more precise understanding from using one piece of software and have trouble when their expectations based on this concept are not met when using another program. For example, users often confuse

- columns in a text processor
- tables in a text processor
- tables in a spread sheet

A poor learner will not be aware of the possible mismatch between between preconceptions and novel technology. On the other side, a person with learning competence in this respect will be open for all options of whether aspects of a concept fits in a new environment or not. Also, the experimental competence for testing whether a principle holds will be part of the learning competence.

Understanding and facts ease transfer of skills to new situations (p.9, 16-17, 63, 65)

A computer user who has understood the concept of text flow, and that text flows from one column to another, but not between cells in a table, would be more likely to choose the right kind of tool in the next piece of software.

Handing of a new text processor would also be eased if a user has learnt trivial facts like that Times New Roman and Arial are fonts, because then it is easier to recognise that where these words appear, the functionality concern fonts.

Computer applications are built on principles from computing, like functional dependency, hierarchical data structures, separation between layers, type-instance relations, so learning competence is enhanced with understanding of more of these principles. Also, assuming that the general findings from pedagogy apply, facts like vendors, file formats, and knowledge of people to ask for help would constitute parts of the learning competence for computer users.

People are active (p.12-13) and communicating (p.25) learners

People's experimental activity at learning new ways of working was mentioned under “learning oriented students.” The cooperative nature of learning activities requires that uses also need to be able to communicate about software and hardware. In addition to general communicative skills, people need to be able to explain their ideas about computing in an effective manner.

When communicating in front of a computer, people need to explicate what goes on, and possible explanations, so concepts and models of what happens under the surface of the computer are necessary.

When taking on the phone or communicating in writing, people also have to express the computer's operation in a precise and complete manner, so that the computer's behavour can be regenerated. In addition to concepts, detailed facts are needed, like also emphasized in the “Understanding and facts” section above.

The last part of learning competence for communication is knowing whom to communicate with, and this again requires insight into other people's competence. Furthermore, it requires the ability to link up with those who know, like colleagues, super users and support personnel, and engange then into helping out

People who can reflect upon their learning becomes better learners (p.18-19, 67)

Users have been observed to say “This worked last time I did it, why did the computer something else now?” Simultaneously, the observer has noticed that this time the used hit another button than the last time, while the user is convinced that he repeated exactly the same typing. This use does not express any signs of metacognition, or the abilty to reflect upon one's own thinking and behaviour. The possibilityfor learning is blocked.

Metacognition includes the ability to analyse what one did, and be open for re-eaminiation of one's actions. Further, it requires understanding what one does inrelation to a goal, and reflecting on whether other plans could be more effective than the course of action currently undertaken.

A person using a text editor to profuce a 4 pages leaflet struggle with keeping the pictures at the right place on the page and preventing text from flowing between pages when text is

added or deleted. Blank lines are inserted to adjust for page breaks and deleted again when new text is inserted in front.

A person with better metacognitive skills would reflect on her actions and eventually also question the idea of using a text editor for this purpose, remembering that in a presentation program, text and pictures stay on the page.

Seing the usefulness motivates learning (p.61)

The usefulness of a computer application is found in the task subject area of IT user competence.

Summary

The competence which an individual need for learning about IT can be summarised as facts, skills and undestanding:

Facts about the applications and about who knows what

Experimental **skills** for trial-error-success, playful exploration and metacognition, and social skills for making relationships with expertise.

Understanding of concepts and principles, and also the motivation of why a specific functionality is useful.

References

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