Effective pedagogy requires understanding how students learn and tailoring our instruction accordingly. One key element of student – centered pedagogy involves understanding the cognitive psychological processes according to which students learn, and to structure our teaching with these processes in mind. [p.g.3]This paper fills in a gap in the current literature, by applying empirically grounded lessons drawn from the cognitive science of learning, and discussing specific applications of these lessons for information literacy instruction. The paper outlines a framework for information literacy instruction, grounded in the educational and cognitive psychology literature, for facilitating student retention and transfer of information literacy skills, two classic measures of student learning.[p.g.19] Five specific principles and several strategies for promoting retention and transfer within information literacy instruction are outlined.

Key words:

- Psychology literature
- Student centered pedagogy
- Paper outlines
- Perspective
- Scaffold
- Ownership
- Metacognitive
- Microworld

Cognitive tools refer to learning with technology (as opposed to learning through technology). Jonassen (1994) argues that ‘’technologies, from the ecological perspective of Gibson (1979), afford the most meaningful thinking when used as tools’’.

Cognitive tools are generalizable computer tools that are intended to engage and facilitate cognitive processing. [p g. 5]Cognitive tools can be thought of as a set of tools that learners need in order to serve cognitive apprenticeships. They scaffold the all – important processes of articulation and reflection, which are the foundations of knowledge construction. They empower the learners to think more meaningfully and to assume ownership of their knowledge, rather than reproducing the teacher’s. The major problem if we accept this conception of technologies is what to do with all of the instructional designers.[p.g.7] Cognitive tools help learners with complex cognitive learning activities and critical thinking. These tools are learner controlled in the sense that they construct their knowledge themselves using the tools rather

than memorizing knowledge. In this perspective, computer systems are ‘’partners’’ that stimulate learners or groups of learners to make maximum use of their cognitive potential.

According to Shim and Lee (2006), Lajoie (1993) summarized that the cognitive tools can benefit learners by serving the functions as follows:

1. Support cognitive processes, such as, memory and metacognitive processes.
2. Share the cognitive load by providing support for lower level cognitive skills so that resources are left over for higher order thinking skills.
3. Allow the learners to engage in cognitive activities that would be out of their reach otherwise.
4. Allow learners to generate and test hypotheses in the context of problem solving.

The foundation for the use of interactive learning systems as ‘’cognitive tools’’ is ‘’cognitive psychology’’. Computer – based cognitive tools have been intentionally adapted or developed to function as intellectual partners to enable and facilitate critical thinking and higher order learning. [p.g.11].Examples of cognitive tools include: databases, spreadsheets, semantic networks, expert systems, communication software such as teleconferencing programs, online collaborative knowledge construction environments, multimedia, hypermedia construction software, and computer programming languages. In the cognitive tools approach, interactive tools are given directly to learners to use for representing and expressing what they know. Learners themselves function as designers, using software programs as tools for analyzing world, accessing and interpreting information, organizing their personal knowledge, and representing what they know to others. The basic principles that guide the sue of interactive software programs as cognitive tools for teaching and learning are:

1. Cognitive tools will have their greatest effectiveness when they are applied within constructivist learning environments.
2. Cognitive tools empower learners to design their own representations of knowledge rather than absorbing representations preconceived by others.
3. Cognitive tools can be used to support the deep reflective thinking that is necessary for meaningful learning .
4. Cognitive tools have two kinds of important cognitive effects, those which are with the technology in terms of intellectual partnerships and those that are of the technology in terms of the cognitive residue that remains after the tools

are used.

5. Cognitive tools enable mindful, challenging learning rather than the effortless learning promised but rarely realized by other instructional innovations.
6. The source of the tasks or problems to which cognitive tools are applied should be learners, guided by teachers and other resources in the learning environment.
7. Ideally, tasks or problems for the application of cognitive tools will be situated in realistic contexts with results that are personally meaningful for learners.
8. Using multimedia construction programs as cognitive tools engages many skills in learners such as: project, management skills, research skills, organization and representation skills, presentation skills, and reflection skills.
9. Research concerning the effectiveness of constructivist learning environments such as microworlds, classroom – based learning environments, and virtual, collaborative environments show positive results across a wide range of indicators.

In summary, thirty years of educational research indicates that various interactive technologies are effective in education as phenomenon to learn both ‘‘from’’ and ‘‘with’’. Historically, the learning ‘‘from’’ or tutorial approaches have received the most attention and funding, but the ‘‘with’’ or cognitive tool approaches are the focus of more interest and investment than ever before. Preliminary findings suggest that in the long run, constructivist approaches to applying media and technology may have more potential to enhance teaching and learning than instructivist models. In other words, the real power of interactive learning to improve achievement and performance may only be realized when people actively use computers as cognitive tools rather than simply interact with them as tutors or data repositories.

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