The Orbicular Model – Cognitive Learning in Cyberspace
By R.S. Gilliver, B.J. Randall and Yang Ming Pok

The continued exponential growth of Internet resources, combined with breathtaking technological breakthroughs which emerge almost daily, have the unintended effect of “intimidating” educators who may be unfamiliar with the use of the Internet as an aid to student learning. In this paper the authors propose a model to explain the underlying theoretical foundation by which Internet learning takes place in an educational environment.

Central to this model, remains our hypothesis, that learning and teaching are distinguishable consequences of Internet use in education. The “orbicular model” we develop in this paper, not only enunciates this fundamental hypothesis, but extends the process of learning into research or “discovery,” from which the loop closes again.

It’s not a Paradigm Shift

Challenges confronting educators have been unnecessarily heightened by a popular misconception that emerging technologies represent a paradigm shift in education. Propagation of this myth clearly de-motivates educators who thereby feel the need to juxtapose style and technology. Not only is that juxtaposition superfluous - it is imprudent.

Fundamental teaching styles, whether instructionist or constructionist, (Papert 1993) are not all at once irrelevant, as a result of accessible technology based tools. Antithetically, they can easily be adapted to an IT platform, and then augmented.

Advances in technology have not abruptly annihilated widely acknowledged and accredited teaching methodologies. Notwithstanding that student accessibility to information now far exceeds the past, and opportunities to experience new and different teaching styles are more frequent, there have been no fundamental changes in basic human learning processes. Educators should not therefore focus inwardly and feel imperiled by technology; instead, technology should be grasped and applied in imaginative and creative ways to intensify cognitive learning for students.

The external environment for educators is awash with opportunities, and technology based tools, to enable rich learning environments to be created for students, built around context-sensitive material, collaborative material, “learner controlled” material, and flexible delivery modes.

Technology will also “tolerate” alternative delivery styles, whether didactic, constructive, unstructured or abstract. Educators can adapt technology to their preferred style. It is therefore our view that there has been no paradigm shift. Proponents of that view are ipso facto elevating technology to an undeserved status of dictating style and content. Instead, technology provides nothing more than a framework and delivery infrastructure to enable educators to be as imaginative, creative, and flexible as they wish.

The Orbicular Model

Fundamental to this descriptive model is the role of the Internet, and the World Wide Web (WWW) in particular, as a vast repository of information. We make no comment or observation regarding the relevance or quantity of such information, except to emphasise the exponential growth of Internet based information; growth which correlates with the declining cost of technology. In our view, this correlation is inexorably a manifestation of Internet users seeking to adopt and adapt the resource to their own needs.

In this context, teaching takes place by educators. Whether that teaching is instructionist or constructionist is only partly relevant to the convergence which inevitably takes place between the learner, the teacher and the syllabus. At the point of this convergence, technology now also plays a role – but that role must not be over-stated. As we stated above “Technology provides nothing more than a framework and delivery infrastructure to enable educators to be as imaginative, creative, and flexible as they wish.” In the context of working with the Internet in education, we therefore see teaching as the active task of inculcating learners with the skills and behavioural patterns to “direct” and “focus” their learning on the Internet.
Cognitive learning is the inevitable outcome of this pedagogical process. At this stage in developing the "orbicular model" concept, we shall pass over the crucial issue of the level of cognitive learning which takes place, but return to this central issue when analysing the implications of the model.

From learning flows "discovery" – the demonstrable competencies of learners applied to their living frameworks. Learner interactions with their environment, whether academic, employment or social, results in “discovery.” New information is thereby obtained, tested and recorded. As this “discovery” process evolves, the product of the process becomes new information available. The loop is closed.

The dynamics of the orbicular model are depicted in Figure 1. The model enables educators to better understand their pedagogical role in an IT based instructional environment. The model is not an attempt to prescribe any form of desired manipulative intervention in that environment. It is instead, a dynamic depiction of the key interactions in an IT based rich learning environment.

Depiction of the process in this way does not imply the absence of “leakage” from the loop. Nor do we imply that all four elements of the model must always be present. We acknowledge that learning does not always require teaching. Learning will not always lead to new discovery. Not all discoveries become new information. We address these discontinuous interactions, in the context of the model’s practical benefits (below).

The orbicular model is offered in the limited context of an IT based instructional environment. It is therefore a context-sensitive framework, offered as an aid to educators, uncertain of their own role in an educational environment undergoing change. Clearly, their role remains at the vital interface, between learning and information, where style, content and pace are still crucial elements to focus and motivate students to learn.

**Dimensions of the Model**

We have already described the Internet and the World Wide Web in particular, as a "vast repository of information…" undergoing “exponential growth.” Beyond the WWW however, are equally valuable educational resources of Internet email; newsgroups; bulletin board services; teleconferencing; audio-conferencing; video conferencing; databases and interactive publications. This is the “information” dimension of the orbicular model, described earlier as an "...environment for educators which is awash with opportunities, and technology based tools, to enable rich learning environments to be created for students, built around context-sensitive material, collaborative material, “learner controlled” material, and flexible delivery modes.”

For effective learning to take place, it is our contention that learners must be taught how to optimise this resource. Teaching will increasingly convey learning skills, not knowledge. Inculcation of these requisite skills must include methodologies for learners to focus on relevant information areas, to comprehend, apply, analyse, synthesise and evaluate what they extract from IT based information. Knowledge per se, is readily available in an IT environment, more up to date than any text-book could offer, comprehensive, and interactive. Teaching must therefore become a responsibility requiring more wisdom than knowledge. The pivotal role of teaching at the interface between “information” and “learning” in the orbicular loop model, cannot be underestimated. The nature of that role however cannot be static. The challenge confronting teachers to themselves master the learning methodologies so as to impart them to students, cannot be ignored. The inevitable consequence of ignoring this reality could only be an increasing irrelevance of teachers in an IT based learning environment.

Much debate has ensued in recent years about the relative merits of constructionist or instructionist teaching styles. The orbicular model, as it applies in an IT based learning environment, renders this debate superfluous. The teaching challenge is to add yet another higher level skill of facilitating student learning using available IT resources. Once this higher level skill is obtained and maintained, generative learning takes place, with minimal “content teaching” intervention in the process. A clearer understanding of the learning process in an IT environment may now enhance our understanding of this required higher level teaching skill.

Bloom’s *Taxonomy of Educational Objectives* (Bloom et al, 1956) is now more than 40 years old. In the intervening period since it was first published in 1956, educators have largely embraced the concept, and widely used the tools. Our contention is that Bloom’s Taxonomy, within the IT environment is today more fundamentally relevant and deliverable than ever. However there is bifurcation between Bloom’s Taxonomy and the orbicular model in one crucial respect. Travers (1980) saw Bloom’s taxonomy as falling short of a true taxonomy. “Although the major categories give the appearance of a continuum of complexity, this dimension is not clear and the classification is only a rough beginning.”

The orbicular model is not a continuum at all. Responding to the IT environment, the orbicular model recognises that...
after the higher level skills of synthesis and evaluation have been achieved, the product of that achievement, which we call discovery, becomes new knowledge available for others at the lower level of Bloom’s taxonomy. In essence the orbicular model explains, in an IT environment, what happens at the end of a continuum. Bloom left the issue unanswered.

We nevertheless embrace the principles of the taxonomy up to that point. Of particular relevance to the orbicular model is the issue raised by Bloom, and researched by McKeachie (1963) and Sharan (1963) in separate publications, that teaching methods which emphasise efficient one-way communication (e.g., lectures) are more useful in helping students to acquire lower-level objectives, while those which emphasise two-way communication either among students themselves or between students and teachers are more useful in helping students achieve higher-order objectives. This proposition has stood the test of time, and been empirically supported by Johnson and Johnson (1994). In an IT learning environment, access to such two-way communication is assured.

Indeed, it is more than two-way, but multilevel communication which is now a central characteristic of Internet learning. The borderless classroom of the late 1990’s, is supported by communications technology, text, audio and video, which enables interaction between students, students and teachers, or indeed students and a plethora of relevant experts. Bloom’s higher order objectives are achievable for students, irrespective of the barriers otherwise thrown up by didactic teaching styles or economic barriers. The environment is also deliverable by teachers despite the historical general reluctance to inculcate Bloom’s taxonomy. Anderson (1996) concluded that since it was first published in 1956, teachers have made such little use of the taxonomy because:

1. “The taxonomy takes far more time than teachers typically have at their disposal,”
2. “teachers may believe that many students, particularly those from economically disadvantaged homes, are unable to master objectives much above the lowest level of the taxonomy – knowledge,”
3. “the taxonomy may be too rational or too complex for some teachers.”

Anderson went on to explain her meaning of this final point. “Conceptualising and applying higher-order objectives in planning, teaching, and/or testing may be very difficult for many teachers...those teachers who are unable to do so lack confidence in their ability and it therefore seems unreasonable to expect they will conceptualise and apply higher order objectives on their own.”

The orbicular model, built on Bloom’s Taxonomy, and applied in an IT learning environment, removes such barriers.

The Orbicular Model as a Practical Resource

Our objective in presenting the orbicular model is to provide a clearer understanding, particularly to educators, of the vital role which teaching continues to play in a turbulent contemporary educational environment. Our contention is that the role becomes even more incisive than ever, if students are to maximise IT based learning opportunities. Our concern is to ensure educators do not abrogate their responsibilities to meet this challenge, because of an erroneous view that they cannot be expected to master the technologies involved.

The orbicular model demonstrates emphatically that educators make their incisive contribution at the interface of available information, and the learning process, therefore engendering the need to develop the necessary skills to meet the challenges likely to emerge at this interface. What are those challenges, and requisite skills, which the model thus precipitates?

Those skills, which must first be garnered, and then ingrained in students, are:

1. Extractive
   - Extract relevant information by search techniques,
   - Focus student tasks into searchable subtasks and topic areas,
   - Direct learner inquisitiveness into relevant areas of scholarship and learning.

2. Interactive
   - Comprehend and interpret information in context,
   - Apply information to situations and problems,
   - Analyse patterns and meanings.

3. Proactive
   - Imparting skills to:
     - Synthesise knowledge and create new ideas,
     - Evaluate concepts and ideas
The orbicular model can therefore be enhanced by incorporation of these pedagogic functionalities, (Figure 2) which fundamentally follow Bloom’s Taxonomy, but which incorporate the “non continuum” style, relevant to IT educational environments.

The orbicular model also focuses our attention on the interface between learning and discovery. We have characterised this interface as being “proactive,” inherent in which might be the prima facie assumption that teaching intervention is unlikely to be strong or strongly relevant.

Discovery is more likely to arise from the proactive behaviour of learners – a manifestation of Bloom’s higher level skills of synthesis and evaluation. However it is unlikely that these skills will exist unless teaching intervention at an earlier stage of the orbicular model has been successful.

At this stage in the development of the orbicular model, it is appropriate to introduce the “time dimension” associated with learning in an IT environment. Unlike Bloom’s Taxonomy which implicitly operates over a traditionally imposed “top down” education cycle of many years, the orbicular model recognises that contemporary IT based learning is a “bottom up” process.

Learning pace is now learner controlled. Collaborative learning can now be implemented as quickly as potential collaborators can be assembled electronically. Synergistic learning can now be organised as quickly as search tools can locate synergistic material. Flexible delivery methodologies now enable learners to choose learning contexts which maximise learning potentials in the shortest possible time-frame.

In such an environment, the time likely to elapse between “learning” and “discovery” might be brief indeed. Contrast this with traditionally held views that seminal thought and publications could arise only after fixed periods of formal education and post education experiences.

Teaching intervention, whilst most likely to be directed to the development of extractive and interactive skills, can and should therefore, also inculcate proactive skills of synthesis and evaluation. These higher level skills need to be imparted at the same time as the lower order skills in Bloom’s Taxonomy, in order to satiate learner demands to move rapidly from learning to discovery. That “movement,” will increasingly occur over decreasing time spans in an IT environment.

The orbicular model then closes as discovery metamorphoses into new information. Almost as rapidly as discovery takes place, it becomes accessible on the Internet, perhaps initially via non text forms through discussion groups, bulletin boards and similar electronic, audio, or video tools. In such form, discovery is passed on as knowledge to new learners.

Again, time is increasingly irrelevant in this cycle. Traditional delays while doctoral dissertations and research publications are published and indexed, are “passe.” Learners discover, and their discoveries are potentially accessible, almost immediately, by discerning learners.

Indeed it might even be concluded that the transformation process, from “discovery” to new “information,” more closely resembles a mutation than a metamorphosis. In situations where discovery is published in text form, and becomes subjected to the voracious indexing of electronic search robots, original research or discovery will reemerge in myriad contexts, and disseminated forums.

DYNAMICS OF THE MODEL

Two important issues of model dynamics warrant our attention at this stage in development of the orbicular model for an IT based learning environment. Firstly, there is a need to establish whether there is conflict between the apparently dichotomous concepts of “mutation” and “closed-loop.” In other words, if exponential growth of information takes place, are educators able to keep pace with such growth or does the orbicular model collapse under the weight of new information?

Instructionists, confronted by such an environment, would likely respond as suggested by Anderson (1996), … teachers may believe that they are under great external pressure to cover as much content as they can in a very short time period. The easiest way to conform to this pressure is to focus almost exclusively on lower-level objectives.

Such a behavioural response would clearly negate the closed-loop concept.

However such a response is unlikely to flow from constructionists, operating in an IT based learning environment. For this group of educators, a rich and expanding learning context generates richer learning opportunities. Our previously stated contention that “…teaching will increasingly convey learning skills, not knowledge,” is the outcome of that constructionist approach. We do not however suggest that constructionist and instructionist styles cannot both be tolerated in the orbicular model approach to learning. Indeed, style will be subsidiary to substance – the ability of educators to impart the skills to be extractive, interactive and pro-active in the utilisation of information resources which are expanding exponentially, is more crucial than style.

The orbicular model is thus enriched, not overwhelmed by growth. The teaching interface in the model, is not directly related to the available quantum of information, and hence learners are able to absorb and benefit from that growth. Teachers can approach an ever growing Internet, with the positive objective to inculcate learners with skills, and not the negative approach that “…the easiest way to conform to this pressure is to focus almost exclusively on lower-level objectives.”

The second model dynamic which must be addressed is that of leakage, from what we describe as a “closed loop” model. This nomenclature does not intimate concreteness in the abstract model. On the contrary, the model is fluid, flexible and dilatory. Information grows exponentially;

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teaching styles, didactic, collaborative, or constructive can all be tolerated; rich learning environments can be enhanced by a comprehensive adoption of Bloom’s Taxonomy, and discovery can take place and be shared with unparalleled alacrity. The model is thus far from being "closed-loop" in the traditional understanding of that term.

Our meaning in a contemporary IT based learning environment, is that integration exists between the four elements of the model. Each phase adds value to the subsequent phase, and this continuum is cyclical, not linear as proposed by Bloom. Leakage, nevertheless, is inevitable at all phases of the orbicular model.

Information
Not all information may be available to learners. To varying degrees of chagrin, copyright issues imperil accessibility to the Internet. Information may at times be protected by password, censorship, intimidatory copyright warnings, or in extreme cases by technical failure.

Teaching – Learning
The efforts of educators to inculcate the extractive, interactive and proactive IT skills may not always be successful. Those skills must first be garnered, then imparted in a motivated, context-sensitive, and systematic framework, otherwise cognitive learning is unlikely.

Learning – Discovery
The path from learning to discovery may at times be convoluted at best; hidden for a time; or lost at worst. The directness and speed with which learning leads to discovery is dependent upon the learner’s motivation, research opportunities, and to a degree, uncontrollable factors which may be inherent in the learner’s employment or educational environment. Learning may not always lead to discovery.

Discovery – Information
Leakage is least likely, albeit possible, to occur in the transition from discovery to new information – a process which is likely to be rapid and comprehensive in an IT based learning environment. Leakage from the orbicular model in these four phases, has no reverberative influences on the integrity of the model. Conceivably, certain leakage’s may be temporary phenomena, and learning or discovery for example may subsequently take place, outside what might be classified as the usual anticipated time-frame. In acknowledging the potential for leakage’s from the model, we seek to reinforce its contemporary viability.

CONCLUSION
The continued exponential growth of Internet resources, combined with breathtaking technological breakthroughs which emerge almost daily, have the unintended effect of "intimidating" educators who may be unfamiliar with the use of the Internet as an aid to student learning. In this paper, we have attempted to put these confronting environmental factors, into a meaningful and manageable perspective by proposing a model to explain the underlying theoretical foundation by which Internet learning takes place in an educational environment.

The orbicular model enables educators to better understand their pedagogical role in an IT based instructional environment. It is a dynamic depiction of the key interactions in an IT based rich learning environment.

REFERENCES

R.S. Gilliver, Graduate School of Management, The University of Adelaide, 3rd Floor, Security House, 233 North Terrace, Adelaide 5005 Australia
Bobgilliver@yahoo.com

B.J. Randall & Yang Ming Pok, Ngee Ann Polytechnic – Dept of Accountancy, 535 Clementi Road, Singapore