

Preface: Most papers about learning theories either assume that there is uniformity in the definitions of the terminology associated with the subject area, or they take time to clarify vocabulary use before beginning. I will do neither. I state this to indicate that I will use terms like “constructivism” or even “learning” in the broadest sense Theorists can and do differ widely on their specific interpretations and applications of a raft of jargon within the field. A paper as short and general as this will necessarily lean toward blanket statements and fairly obtuse points. I would be interested in revisiting this very relevant question in more detail at some point in the future. But for the use of Western as it relates to the upcoming NCATE concerns I summarize below:

### Learning Theory and Technology

Constructivism rests upon the premise of education being learner-centered as opposed to instructor centered. Concepts like *discovery* and *the educable moment* run in congruent paths with cognitivists whose description of brain function also bases many findings on the uniqueness of the individual. On another path, running in similar direction (although arriving at different conclusions), the field of developmental psychology, as endorsed by Developmentalism, paints a picture of the individual as a progressively *different learner* from stage to stage. The needs and propensities of the student are stationed upon the building blocks placed there sequentially. Facilitation of instruction hinges upon that linear point in development wherein student need intersects with relevant knowledge.

### Hardware vs. Software

Technologies in education, which are software or program-based, have altered education profoundly in the past decades and will continue to do so. Hardware and infrastructure developments are also significant in this evolution, but perhaps change education in form and scale more than in foundation. By this distinction I refer to examples like the technologies for presentation/communication as opposed to technologies that think.

## Dumb Gadgets

Phones and film projectors and radios and television are all technology, but one can argue that they have done little to alter the **form** of education. Scale is radically changed as millions can hear what once could only be shared with a handful. Yet, it is important to recognize that this is not the Gutenberg experience again. Instead, it may be seen as the opposite. While the printing press allowed thousands to read and know what only dozens could before, it also created a literate and therefore structured-thinking populace. With radio, and now with the additional visual lure of television, the masses are becoming post-literate as they once again draw the majority of their knowledge in the non-linear, and randomly structured environment of the remote control. So although a very important change in sociological function, these boons to communication (and advertisers) serve as impediment to traditional educational goals. They have not significantly changed learning theory or practice, rather it can be said their glut of vacuous information serves to pollute the initial resource. To restate this “hardware” point: with or without filmstrip projectors learning goals and techniques vary little. Certainly the damage done to literacy-based instruction seems to outweigh any ancillary benefits that these same technologies provide.

## Smart Gadgets and Getting Smarter

Software, or *the thinking end of technology*, meanwhile, alters both the learning goals and the nature of the content itself. In the past decades the advent of the calculator has significantly changed the study and instruction of mathematics. Just as the word processor and now computer have altered language paradigms about what should be taught and how that instruction should take place. Certain rote lessons existed as the fundamentals of the vaunted three R's. An educated person was expected to store internally a wealth of information, all of which is now available a keystroke away. It has long been accepted that being a true *renaissance man* is no longer achievable, but with the recent increase in

knowledge and access to it, it becomes exponentially more difficult. The available knowledge base and the changing nature of the world itself is such that now there is not a prescription for being “well educated,” rather the model is “learning to become a learner.”

The growth of the PC market, and the ubiquity of these and variant devices is not in of itself any indicator of the influence of technology on education; anymore than the prevalence of people with telephones in their homes is indicative better national communication skills. However, the proliferation of these devices (to the point that there is the beginning of a nationwide saturation) coupled with **meaningful software** that is **truly interactive** is indeed significant. This alters how we store, retrieve, filter and finally use information. Whether the application or information is resident in one’s computer, like a “maps” program, or if it is dated information from Moscow, is irrelevant. This is virtually transparent to the user and will become more so.

### Interactivity

It is the interactivity of the program that will ultimately determine how crucial the information is to education. Software creates machines that think. If one can access all knowledge at any time and this can be put into any form you desire, from term paper to television show, and then shown to as many people as you like in any number of transmission forms then we are looking at a new world indeed. But how does this abundance of information affect the learner (and we are all “the learner”)? How does this affect the learning environment? Thinking technologies have the greatest impact, in that they can ascertain from the user what that individual knows or doesn’t know; likes or dislikes; has done and has yet to do.

### Filters and Targeted Information

Information in an information age ceases to be a commodity and becomes a flood. The problem is not finding data but finding meaningful data. Learners are faced with the satellite-dish dilemma: a thousand stations, yet none with the show that you want to watch. Thinking technologies are now, and will be more so, able to start with the individual and diagnose through myriad techniques where the individual student's abilities, interests, and deficits lie. Curriculum in the world of software design is oddly more linear than in many more traditional texts. As such, it assumes a developmental base of incremental improvement and change. Interaction with the student's keyboard, mouse movements, voice, and even gestures can create a massive database on the individual student in short order. This is not a general demographic target created by a testing firm and then filtered through a textbook committee in Texas. This is individual assessment and filtering for the individual. The filtering, choosing and discrimination of what is appropriate, challenging and necessary were tasks fully approached by the instructor previously and when the educational resources become virtually infinite this already difficult task becomes even more daunting. As thinking technologies become more efficient and targeted in educational settings the selection of materials and strategies for implementation can be suggested through the human/computer interaction.

### The Human Element

With all of these advances and varying interface possibilities it is crucial to keep in mind that the software is **not** now being written by computers. Educational programs are designed by educators. Sequence of instruction can be infinitely specific to the individual, but its brilliance or uselessness is attributable to the person behind the program design. The curriculum and the decisions about how much time the learner spends with some technological marvel or with their fellows on the playground is still best decided by the instructor. Whether an e-

book or a kiosk or a laptop or a wrist watch PDA all of these interface units must be determined to be valid tools by an instructor. There is no conflict with instruction remaining student-centered. Meaningful instruction can be enhanced by these tools, and these are powerful tools. They can create an environment that is fully constructivist: the “gifted” kid can be challenged every day, the student in need of serious remediation can be seriously remediated, all the while the instructor can facilitate instruction and make the “human” call about how much tech, how much traditional lecture, how much group work and who gets and misses recess. Instructors who can use these new and ever changing tools to meet students where they are as individuals and then meet them there with the best tools to enhance education.

### Summary

Constructivist theory in education is complemented by “smart technologies” in the classroom. The single thing that is the most exciting about the educational technology is its amorphous nature. The device used for interface can vary from the typical keyboard to eye scan assistive technologies: meeting individual learners exactly where they are. This is window dressing compared to the infinite amount of functionality that can be resident inside machines: preparing thousands of types of lessons and learning environments, each potentially designed for the needs and interests of the individual student. Content areas and domains in which these increasing possibilities can be initiated are appropriate in some and out of place in others, but this significant tool set should not be seen as an evil nor as a panacea. Each variation on theme within educational technology is exciting or useful within a specific context, and moreover as directed toward individual students. The heart of the constructivist view is learner-centered pedagogy. These new technologies facilitate a more complete realization of this than perhaps anything except a one-to-one pupil teacher ratio.

The individualization and ever-changing nature of these technologies is also complementary to a developmentalist perspective for much the same reasons as stated above. The educator's primary task is always assessment first and assessment last. If one does not know what the needs and gaps are then proceeding to the task of *helping the learner learn* is arbitrary at best. Worthwhile technology in a classroom situation can create a completely flexible environment where each student is met at his or her own level of need, interest and ability. The development of these individuals can be seen and accommodated and reinforced *in part* by these technical affordances. (The qualifier of 'in part' is added in deference to the instructor's larger and more complete pedagogical goals.) The information and challenge offered by the technology is constantly changing, as is the student, thereby making this tool fully developmental.