Learning Principles Incorporated in the Design of The Lifetime Library®

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Introduction

The Lifetime Library® is a multi-media educational resource designed to provide learners with the academic skills required for successful lives, careers and higher education. Its intended audience is young adults and adults who have identifiable gaps in their K-12 education. This highly interactive multi-media software design is based on fundamental learning principles grounded in sound psychological theory. This analysis of the Lifetime Library illuminates the learning principles the program is based on, and examples of how they are employed.

The Characteristics of Adult Learners

The Lifetime Library is targeted to young adult and adult learners, who as a group have some similar and some different characteristics than the typical K-6 students who study basic educational content. The design of the Lifetime Library was guided in particular by these principles of young adult and adult learning:

- Prefer to be treated as mature individuals.
- Have been gaining useful 'past experiences'
- Are intrinsically motivated
- Have learning needs which are becoming more concrete and immediate
- Are sometimes fatigued and are impatient in the pursuit of learning

The Lifetime Library makes extensive use of adult role models, both successful and striving to be successful. Learners practice on realistic adult problems, whether they are mastering reading, math or writing skills. The Library relies on an "open architecture" that leaves the learner in charge when making instructional decisions. Choice is also provided by offering a variety of online resources at all stages of instruction… such as an interactive dictionary, calculator, audio narration and "bookmarks."

An Important Distinction - Training, Teaching, Education, and Reference

While it is essential to treat the users of the Library as adults, it is also critical to be clear as to the purpose of the program. The Lifetime Library is designed to teach basic education skills. Training applications are linear in design and because of their short contact time, they present few opportunities for digression. The Lifetime Library falls between the categories of teaching and education. The learners have sufficient time to master skills at their own pace; the core structure of the program is highly structured to provide a "best path" for learning; but it is not restrictive. Learners can branch out from their learning and explore new topics at will. Its essential design elements are freedom on the one hand, but clear guidance on the other. This is an appropriate design because typical young adult and adult curricula are either too open-ended or too restrictive. Young adults and adults seeking basic educational skills chafe at being overly directed, but will rarely succeed if offered non-linear resources such as free access to the public library.

Learning Theories – Behaviorism, Constructivism & Cognitivism

The Lifetime Library draws on the best of three learning theories: Behaviorism, Constructivism and Cognitivism. Its eclectic design allows it to take full advantage of the opportunities provided by its mode of delivery and the entire range of media incorporated into the program.

Behaviorism is primarily concerned with the measurement of observable behavior. Constructivism offers an approach to learning that encourages learners to construct their own reality or interpret new ideas based on their own perceptions and beliefs. The Learning Theory with the greatest number of direct applications in the Lifetime Library is Cognitivism. "Cognitive theorists recognize that much learning involves associations established through contiguity and repetition. They also acknowledge the importance of reinforcement, although they stress its role in providing feedback about the correctness of responses over its role as a motivator".

Application of Cognitive Theories in the Lifetime Library
Individual Differences:
All people learn in different ways and at different rates. As the effects of previous experience accumulate, the diversity of learning style increases as individuals approach and reach adulthood. Computers offer an opportunity to accommodate differences among learners. The Lifetime Library offers flexibility to individual learners in three important ways.

1) It recognizes that young adults and adults often have "gaps" in their learning, and it provides guidance for addressing these gaps through a variety of strategies. Assessments in the "Test Center" are norm referenced and allow learners to compare their academic ability to national scores. This important first evaluation provides individuals a means to determine their priorities for instruction. The Placement Tests in the Test Center are criterion based and determine the best placement for individuals to begin their instruction in any of the major instructional strands: Math, Algebra, Reading and Writing. Within each lesson, the learner has the ability to challenge the "Final Test" at any time to determine whether they have mastered the skill.
2) Individual differences in learning speed are addressed by allowing learners to proceed at their own pace, they re-read material at will, and to review audio and video instruction at any time.
3) The multimedia approach in the instruction increases the opportunity for learners to maximize their learning style.

Motivation:
Learners are more engaged in their learning when their attention is focused by a need, interest or desire to learn. The Lifetime Library applies a strategy of appropriate placement and relevant instruction to maintain learner involvement. Users only study those subjects in which they need instruction and practice and the assessments reflect typical life situations, whether it is math, reading or writing.

Learning objectives and pre-learning preparation:
The chances for success increase when learners are informed about of what they can expect to learn and are prepared to learn it. The "Objectives" stated in each book specifies the intended outcome of the instruction and the "Life Problem," "Overview," and "Highlights" descriptions prepare the learner for the lesson content. Furthermore, the books and their chapters are systematically structured to provide a sound base for later instruction.

Organization of content

When information is structured and carefully sequenced it is easier to learn and remember. Also, the rate at which new information is introduced is affected by the complexity of the subject matter. This "Organization Effect" is a cornerstone consideration in the overall curriculum of the Lifetime Library and is enhanced through its underlying "book metaphor". Each of the major strands of the Library is organized on a model that is self evident to the learner. The Math Series presents basic math skills in a hierarchical order and is based on the National Council of Teachers of Mathematics Standards as is the Algebra series. The Reading I series progresses through practical (document) reading through general (short text) reading and into prose literature. The Reading 2 series emphasizes reading in content areas and provides instruction on reading literature, science and history. The underlying structure of the curriculum is revealed on the program "Bookshelf." Within each book or lesson, the organization is always evident and consistent. The learner always has clear sense of where individual screens (frames) of instruction fall within the total organizational structure.

Participation and association

Information must be internalized for learning to occur. It is not sufficient to read, hear or view new material. Specifically, it is essential that learners actively participate in their learning on a frequent basis because long periods of passivity are counter productive. A key concept of Cognitive Theory is the Three Stage Processing Model which includes:

1. Sensory register or receiving input. This has an effective time span of up to four seconds.
2. Short term memory which entails holding approximately seven items of information for about 20 seconds.
3. Long term memory and storage with an unlimited capacity for unlimited time.

Association is the principle that learners remember better if they have many associations (links) to new information. The Lifetime Library provides a media rich format that fosters sensory registration. It also provides frequent interactions for the learner within the core instruction through it questions with immediate feedback for the learner. Finally, long term memory is enhanced through the use of the practice exercises and final tests. The simultaneous presentation of text, graphics, photographs, sound and video ensure multiple associations for the learner. This increases the opportunity for later recall of information.

Practice

In order for learning to occur, new information and skills have to be practiced. The question structure identified above provides a means for learners to use new skills in increasingly more complex and novel situations. Learners apply new skills in the specific context they are presented on the instructional pages through interactive questions. The practice questions provide an opportunity to apply the skills to novel situations with an important set of aids, the "Hints" and "Answers" available for explanation of recommended approaches. Then they practice the skill as they would in real life on the Final Test for each book.

Application of concepts, principles and rules

Complete understanding only takes place when the learner is able to transfer learning to new situations. They must be able to recognize which concepts, principles or rules relate to these situations, and then they have to apply the correct one to the circumstance. The Learning Library uses practice and test questions that reflect the problems commonly encountered in adult life. The questions require the newly acquired skills to be applied to novel situations that the learner is likely to encounter in their lives. Whether this is a math problem dealing with a purchasing decision or a reading comprehension problem requiring the interpretation of a document such as a lease, the idea is that they can actually use what they have learned in the instruction. This is the real test of the program's effectiveness, not just the completion of tests.

Feedback and reinforcement

When individuals are informed of their progress, learning increases. It is essential that learners have knowledge of their performance in order to improve it. This also increases motivation because success builds confidence and affects future learning in positive ways. Feedback is provided in a variety of ways in the Lifetime Library. The entire program is very extensive, and learners could easily become overwhelmed with its opportunities if it were not for the "Progress" records available for individual lessons and the entire curriculum. At any time, the learner has access to information about success on practice questions and final tests as well as indications of how much time has been devoted to each aspect of the course. Specific feedback is provided in different ways as the learner progresses through each lesson. As described above, when a learner responds to an instructional question (designated with a letter Q) the feedback is automatic and immediate. When learners answer practice questions, the feedback is available as soon as they commit to an answer. This initial answer is recorded, but the learner has the opportunity to receive hints or to change the answer. At the end of the practice the learner is given the summary results of the entire practice session. Within the Final Tests the answers are not provided, but the success on the test is revealed on a bar chart. In addition, the learner can review which questions were missed to better inform their remediation.

Multi-Media Design Principles Applied Via the Book Metaphor

A fundamental concern in any instructional design for individuals is the navigation, presentation and integration of learning resources. This is particularly true of large complex multi-media systems like the Lifetime Library.

Navigation:

The Lifetime Library "book metaphor" provides an exceptional organization and framing vehicle for addressing navigation. On a purely conceptual level, the book metaphor offers a subliminal nod to the central theme of the program – literacy. However, from a design standpoint if offers much more. Navigation aids orient the user and provide a sense of direction. The book metaphor "grounds" the learner at all times within the program. The bookshelf with its navigational sidebar and constitutes a graphic interface for the user offering direct access to any lesson or resource in the entire program. Books are divided into chapters, each with a consistent design. A complimentary "Exercise Book" is directly linked within each chapter. Finally, the pages themselves force good layout and design by the helpful constraints they offer.

Organizational Strategy:
Multimedia instruction should be clearly organized and the pages should be logically linked. Strategies for organization often include sequence, grid, hierarchy, and web. The Lifetime Library utilizes hierarchical format, however, the book metaphor disguises it as a sequence design. Learners can move from the "Home" to "Bookshelf" to "Book" to "Chapter" to "Page," directly and with confidence.

Information Chunking:
Information on a screen should be organized in a way that facilitates information processing and reading. The critical aspect of this principle is the amount of information presented on a single screen. It is often observed that print based books solve this problem automatically by their size constraints. The "book – page" metaphor forces the presentation of information to follow a 'one page (screen) – one concept" format.

Readability:
The ability of the independent learner to interpret and comprehend the written word is the single most important variable in multimedia design. Among other things, readability is influenced by text length, vocabulary and words per sentence. Short declarative sentences using common vocabulary are most easily understood. Again, the "page" format forces developers to discipline their word choice and sentence structure. Other factors that influence readability include supporting media (see discussion below). The readability of the Lifetime Library is estimated to be about that as a typical 12 year old student – the same as most newspapers.

Font:
Readability is understandably also influenced by the size and choice of font. The Ariel font selected for most of the text in the Lifetime Library because it is sans serif is more easily interpreted. It is also sufficiently large to avoid eye strain. While a wide variety of fonts are available, the Lifetime Library makes minimal use of multiple font designs on a single page as this will also reduce readability if used to excess.

Color:
A consistent color scheme within sections is a helpful navigational tool. Color can be used to group information or to distinguish elements on the page from each other. In addition, if used purposefully and conservatively, it enhances the readability of text.

White space:
The visual appeal of a page is often determined by the amount of white space. For example, if only 50% of the screen (page) is taken up by text it leaves room for the navigational elements, appropriate media and "nothing" or white space. The text on a screen should appear "approachable." That is too say, it should not seem forbidding or too difficult to read and comprehend.

Feedback integrity:
Studies have shown that if feedback is disassociated from questions or exercises, its effectiveness decreases. The pages in the Lifetime Library apply a principle of always directly associating feedback directly on the same page as the questions it answers. This is true regardless of whether the feedback is a simple "Correct" or if it is a full explanatory text box providing logic for the answer. It is also the case for "Hints" and other aids. Note that while the dictionary and calculator are tools rather than feedback, they can be employed directly on the screen while the learner responds to questions.

Media integrity:
The greatest potential for enhancing or degrading learning in multi media lessons is the use of associated media such as graphics, photographs, audio and video. These elements play an important role in "dual encoding theory"; however, they must work in concert with the text.

Course Management
The Lifetime Library is designed for individual use and individual feedback. However, it is often administered through an organizing agency such as a school, library, or other institution fostering young adult and adult education. Given the private nature of individualized instruction, the intermittent contact with young adult and adult learners and often the size of the "class," course management is a major concern for course administrators. There are three principles of course management that the Lifetime Library directly supports:
- Time management
- Student feedback
- Student tracking and analysis

Time management:
Novice learners often have a hard time pacing themselves and evaluating how long it will take to master new concepts. This is aggravated with non-print instructional strategies because learners cannot simply page through material and gage how much there is. The Lifetime Library is organized in such a way that learners can successfully acquire new skills in a single session. Typical book chapters and tests can be completed in less than an hour; entire books are typically accomplished in four hours or less. This fits well into busy young adult and adult schedules.

Student feedback:
Providing meaningful feedback to learners is a challenge for any teacher, but it is even more difficult when managing independent learners. As described earlier, the program itself provides a wide variety of feedback information to the learner through the following:
- Assessments
- Placement tests
- Book page level questions
- Practice exercises
- Book final tests
- Progress records

The instructor also has access to the progress records and can use the extensive detail available there to provide individual feedback and encouragement to the learner as appropriate.

Student tracking and analysis:
The Lifetime Library keeps extensive tracking records for analysis. Instructors can use this tracking to judge the "time on task" for learners as well as their progress on practice exercises and tests. Of equal importance is summary data available to teachers about groups of learners. This provides a straightforward means to judge the advance of an entire class.

Media Theory
The appropriate application of media in instruction offers designers a way to not only enhance learning, but to leverage it for positive results. The primary media used in the Lifetime Library include:
- Graphics
- Photographs
- Audio
- Video

Each of these has characteristics that are exploited in the Lifetime Library to achieve successful instruction.

Graphics:
Graphics play an important role in providing context and for navigation with multi-media programs. However, graphic elements directly related to the instruction can be particularly powerful. They can illustrate the essence of concrete objects, or symbolically represent concepts. The math lessons in particular make extensive use of graphics to visualize concepts. In reading they are used to isolate and highlight text within documents and separate it from the instruction. Graphics can also connect a series of frames with closely related concepts by holding the same or similar image in one place on the screen.

Photographs:
Like graphics, photographs add a visual dimension to learning that cannot be accomplished by text alone. Visuals such as graphics and photographs are generally recalled better than verbal information by learners, and so enhance learning through better recall and association to textual content. More importantly, however, photographs depict real situations and are rich in content. They help anchor the instruction to concrete examples and aid the learner in making a connection to the real world. Photographs help achieve relevancy in the instruction.

Audio:
The primary benefit of audio is to enhance reading and even mitigate reading challenges for the learner. It not only provides a second means of acquiring knowledge, but it adds new dimensions by providing correct pronunciation and verbal inflection. Evidence shows that the brain processes aural information faster than visual information, so it does little to distract the learning process. In some situations it can provide "Dual Encoding" to promote recall and promote association.

Video:

Video is a complex media that incorporates other media within it to provide a rich context for learners. It weaves together graphics, photography, motion and sound to replicate real or imagined situations. The Lifetime Library utilizes the following characteristics of video to reinforce instruction:

- When employed as direct instruction as it is in many of the math lessons and reading in the content areas, it takes full advantage of its careful format to eliminate tangential content and focus to increase learner retention.
- When employed as a narrative as it is in the Math Three lessons and Reading I, it provides relevance for the learner by showing adult situations in which new skills are applied successfully. Narrative in particular is a powerful association for learners because the underlying structure of stories influences the recall of details and character motive influences learner comprehension.
- Video has a powerful motivating effect on learners. Lower ability students in particular enjoy visual (film) experiences more than reading, even though there is little difference in the retention of material presented in text and film. In addition, video (television) has been shown to stimulate interest in reading.
- Finally, the use of adult role models, whether they are instructors, personalities, or adults mastering new skills, is a significant factor in changing attitudes among learners.

Summary

The Lifetime Library is designed to provide learners with the academic skills they require to be successful in their lives, careers and higher education. The design and development of the program was guided by well-established principles of adult education, cognitive learning, multimedia design and media theory. This short discussion has identified the fundamental design principles applied to the product, and provided examples of how they were employed.

Multimedia instruction is a highly complex and highly effective method for teaching basic educational skills. While this discussion has identified the science behind the design, the true impact of this program is the art employed in its development.