**Ideas and Learning**

**Introduction**

Traditional learning might be illustrated by a linear process. In learning a subject, the first step might be a history of its development. A second step might involve difficulties or challenges encountered. A third step might depict current conditions and concepts. The introduction of information in a linear fashion best matches the teacher-lecturer or ***authoritarian-knowledge-source*** mechanism providing information in a way that is satisfactory to the provider. The intent is to clone the mind-set and to store the information in the student’s mind as it is stored in the lecturer’s, thus creating a copy of the knowledge possessed by the teacher.

Not everyone is satisfied with this linear process. Some prefer self-selection of topics and enjoy the pursuit of various aspects of the problem before actually capturing what would be considered as the essential information in the linear path. These alternative learning approaches shift the authority to the student and introduce a new role for the teacher. That is, one of being a coach or a guide.

Educational methodology has gone through a number of changes through time while remaining essentially the same. Bloom (1956) deviated from the preceding approaches by dividing the learning process into a series of functions. Subsequently, scholars cited the functions using Bloom’s or other’s labels without moving the process further.

If Bloom’s descriptive functions actually set the stage for enhanced learning, more is needed in addition to a label. Tools providing measures of attributes, criteria for managing these measures, and decision-rules would be essential ingredients. Those coupled with the inherent intelligence of the individual would facilitate rapid, effective learning.

Traditional approaches have been successful when sufficient pressure is put on the child. Asian cultures insist that children excel and these children are noted for their ability to learn. They are recognized for their ability to acquire existing knowledge and to translate that into demonstrable mechanisms.

***Learning for description*** vs. ***learning for knowledge generation*** appears to require different procedures. With time and energy, an individual can learn to describe phenomena by focusing on memory and recall. Those were the initial functions recognized in Bloom’s taxonomy. Western psychologists introduced measures of intelligence in terms of the individual’s ability to recall.

***Learning for knowledge generation*** obviously needs prior knowledge and the ability to recall elements on demand. The knowledge elements may be different. One possibility is that intelligence ***leading*** to knowledge generation needs informational building blocks, methods for constructing new and existing descriptions of arrangements of these blocks, criteria for the management of these arrangements, and decision-rules for the selection of relevant ones. These needs when translated into Bloom’s taxonomy consist of the following functions: ***synthesis*** (the construction of these informational blocks); ***comparison*** (the development of measures to describe attributes of these constructions); ***evaluation*** (the development of criteria to distribute the arrangements based on importance, feasibility, interest, cost, etc.); ***judgment*** (the selection of arrangements that have special attributes), and ***application*** (utilization of a particular arrangement to acquire new knowledge).

To some, this set of needs might be similar to those expressed in statistical methodology. That process, with its emphasis on formalized actions, transparent selection of measures, analytic methods, and interpretation of findings, is often considered too robotic for those who have been trained in the traditional educational approaches. Instead of the well-known ‘***eureka’*** associatedwith an unanticipated discovery, there is a more subdued ‘***of course’*** associated with the formal, transparent process leading from synthesis to application to findings.

The explosion of information beginning with WWII and escalating thereafter has made the continued application of traditional educational methods difficult to defend. A number of alternative approaches have been introduced with names suggesting a need to go beyond the traditional. A few of those are described.

***Problem-based learning*** is an attempt to deal with defined situations presumably making it easier to consider the elements contributing to the phenomenon and how to correct the situation. Without new cognitive tools, the major change is in the definition of the problem to be addressed. Recognition of the problem is usually the result of a long, tedious process. By beginning with the end result of the traditional trial-and-error behavior, the learning could be enhanced by prompt recognition of the elements making up the problem and how they are related. In terms of ***learning for description***, problem-based learning is a significant step forward along the linear path of learning.

***Just-in-time learning*** is an attempt to provide specific information in dealing with a specific attribute or problem. This is a modern version of the encyclopedia. Examples of this approach are numerous in the internet. Using a search engine, the hundreds, thousands, or millions of websites that presumably provide the required information are identified. This approach has been a source of concern. The user must decide which sites are providing credible, accurate, and current information. Without cognitive tools to assist, acceptance of relevant information is difficult.

***Informational experience learning*** is an attempt to acquire insights regarding a phenomenon from individuals who presumably have experienced the problem. This approach is a refinement on the ***just-in-time*** process. Reduction of the myriad websites presumably providing information is accomplished by ignoring those sites. Instead, individuals are selected and organized as a focus group. Their comments are subjected to a form of text analysis known as Grounded Theory and themes representing elements of the phenomenon are developed into a description.

The selection of subjects to interview is an obvious issue in this learning approach. Do the individuals selected share common experiences or similar encounters with a phenomenon? Are they effective in communicating their observations, perceptions, and opinions? Does the analyst have common knowledge with the respondents so that the developed themes are specific and accurate?

***Lego learning*** is a different approach involving construction of concepts and subsequent text descriptions using informational building blocks. The particular building blocks of interest (i.e., ***ideas)*** have been cited as important and relevant throughout history. Selected quotes dealing with ideas were extracted from (ideachampions.com):

***"If at first, the idea is not absurd, then there is no hope for it." - Albert Einstein***

***"Ideas are like rabbits. You get a couple and learn how to handle them, and pretty soon you have a dozen." - John Steinbeck***

***"There is one thing stronger than all the armies in the world, and that is an idea whose time has come." - Victor Hugo***

If ideas are important in the creative process, the definition of an idea should be clear and concise. Instead, the dictionary underscores the confusion -- ***any conception existing in the mind as a result of mental understanding, awareness, or activity.***  The confusion comes from the meaning of conception which is defined as a notion, thought, or idea. Substituting idea for conception in the definition gives – An ***idea*** is any ***idea*** existing in the mind as a result of mental understanding, awareness, or activity. To further illustrate the confusion, an idea can be expressed as a word, a combination of terms, or larger text. This definition considers one aspect of the idea process, namely, the formulation of one as the result of private mental activity. There is another aspect, namely, the recognition of an idea presented by an individual. Recognition requires an operational definition of the term – idea.

Separation of the two aspects of the idea – formation vs. recognition – offers an effective approach in text analytics. The recognition process can employ a definition motivated by a simple sentence. That sentence is constructed as a subject, verb, and object. The subject-object pair forms a thought independent of the status or emotion expressed by the verb. As a result, an operational definition could be simply – ***a combination (e.g., pair) of informative terms provided by the author within the domain of a sentence.*** That definition ignores the mental creative process and proceeds directly to the idea presented by the individual. Software can be constructed to recognize, extract, and organize ideas satisfying this definition. Text analysis employing ideas as the essential data can be performed.

These extracted ideas can be organized as a database of essential building blocks. With that repository, cognitive actions can begin with synthesis and proceed through application. The traditional retrieval and analysis functions, using computer and manual methods, have been estimated to require about 90% of the effort associated with generating new knowledge. If so, the remaining cognitive functions in Bloom’s taxonomy would be assigned 10%.

With the idea database in place, there is a shift to the higher cognitive functions. This shift results in 10% clerical functions (retrieval and analysis) vs. 90% higher order cognitive functions. This shift has two advantages. The first is shortened time overall in completing the learning objective. The second is more time and effort devoted to developing the final scenario. In terms of learning models, the shift forces an introduction of non-linear learning. The analyst, employing ideas, has more independence in constructing alternative descriptions of the phenomenon as well as formal, transparent paths to the final application.

Why are ideas similar to legos? Legos come in different shapes to fit different purposes. In a comparable fashion, ideas range from well accepted to unimportant at any point in time. The difference is that legos retain their shape while ideas can be changed in importance. Both legos and ideas can be used to build a variety of different structures. Legos are available in different colors to allow differentiation in the appearance of the structure. Ideas can be classified into one or more dimensions making up a topic. General classifications are:

***Personal Factors*** – those describing the individuals or things studied.

***Environmental Factors*** – those describing the physical, social, and psychological climates in which the subjects are found.

***Subject Factors*** – those describing laboratory and clinical factors representing the subject studied.

***Interventional Factors*** – those describing physical, chemical, psychological, and educational factors that are intended to modify one or more of the subject factors.

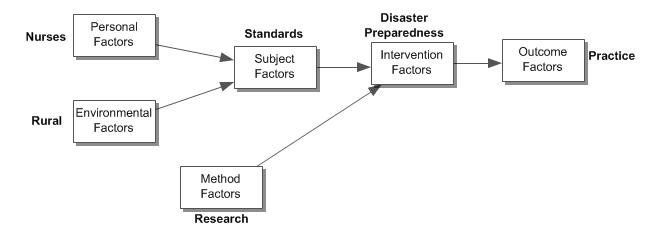
***Outcome Factors*** – those describing results of intervention-interaction with subject factors.

***Methods*** – those procedures employed to accomplish management of factors in any of the categories.

Any selected application-arrangement of ideas could be called a testable hypothesis or the question to be studied in a research program. It is the ***best*** arrangement of the existing facts and represents the most plausible portal to new understandings. Those results will be determined by the new study. In this sense, the process of developing a study hypothesis and the process involved in populating that hypothesis with new information are transparent, quality-controlled events. Learning accomplished using this approach can be described as a system of formalized performance of specific tasks, transparent critical thinking, or simply as research.

It also has many attributes of ***Problem-based learning***. The difference is that the student-analyst can be responsible for developing the problem as well as solving it. The teacher-coach-guide could be replaced by the authors providing the ideas in their peer-reviewed publications. By comparing how the authors used the ideas relative to the new uses, students can develop the necessary measures, criteria, and decision-rules. With respect to memory functions, the student learns to store the construction process along with the elements involved plus the relevant findings. This process results in long-term memory, a desired attribute of intelligence.

An example of the idea construction process is given in Figure 1. The graph shows an example research strategy describing rural nurses as the study subjects, American Nursing Standards as the subject material, disaster preparedness education as the intervention, and nursing practice as the affected outcome. The method identified was research. The research strategy tends to combine ideas containing high and low frequency terms. In this example, rural, disaster, preparedness, research, American, nurse, and practice are high frequency terms. The low frequency ones are nursing, professional, development, scope, and standards. When viewed this way, the research question would be – ***Are the nursing professional development scope and standards effective in enhancing nursing practices in the event of a disaster?***

**Figure 1. Research Strategy Based on Terms and Ideas.**

The dimensions shown in Figure 1 represent specific components in describing a desired action. The study subjects (***personal and environmental factors***) are presented with specific information or actions (***intervention factors***) based on existing knowledge (***subject factors***). The result of this is seen as a change in status (***outcome factors***). The procedures involved in accomplishing this action are ***method factors***.

The template approach can be employed to develop and evaluate various research strategies. As such, it is useful in the cognitive process leading to effective generation of new knowledge. It is a form of simulation enabling the analyst to visualize the system that will be transformed into specific procedures by the construction of the research protocol.

Disaster science was selected because of the interest in developing more effective ways of dealing with natural and manmade crises. The analysis involved over 29,000 documents. There were over 2700 ideas involving the term – hurricane. Disaster was linked with hurricane 108 times while health and hurricane occurred 61 times. As an example, Table 1 shows an excerpt of the vocabulary used by authors in forming ideas describing characteristics of hurricanes. These data are part of an ongoing construction of a database of disaster-related ideas for the Center for Disaster Research and Training, Vanderbilt University.

**Table 1. Excerpt of Hurricane Ideas Vocabulary. (1980-2011)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ALPHABETICAL ORDER** | | | **FREQUENCY ORDER** |  |
| **Term** | **Freq** |  | **Term** | **Freq** |
| academic | 1 |  | Hurricane Disaster Ideas | 2784 |
| access | 4 |  | disaster | 108 |
| accident | 1 |  | health | 61 |
| accurate | 1 |  | flood | 47 |
| action | 4 |  | experience | 46 |
| activation | 1 |  | stress | 41 |
| active | 4 |  | provide | 39 |
| activities | 2 |  | mental | 37 |

The large number of ideas that must be processed to find the ones that are relevant is a condition of text processing made feasible using software. Of the various ways used to describe documents, accuracy and completeness are accomplished best by identifying the authors’ ideas. To do that means that each document must be read, the ideas extracted and organized for future use. The use of software enabled this effective triaging in a rapid and efficient fashion.

Table 2 shows an excerpt of the ideas involving hurricane. The table shows ideas involving the central term – hurricane. Each record contains that term plus a related one and the location data. The first sentence shown deals with document identified as PMID 1485290 in the PubMed repository. That sentence contained six informative terms. Hurricane is the primary term of interest and is linked with the five related terms. Those are highlighted in the identified sentence.

The sentence was –

***In this article we describe the efforts of local authorities to detect and treat casualties caused by a hurricane that struck the west coast of Norway January 1st, 1992 and prevent further injuries. [*[Ranhoff AH](http://www.ncbi.nlm.nih.gov/pubmed?term=Ranhoff%20AH%5BAuthor%5D&cauthor=true&cauthor_uid=1485290),** [**Naustdal H**](http://www.ncbi.nlm.nih.gov/pubmed?term=Naustdal%20H%5BAuthor%5D&cauthor=true&cauthor_uid=1485290)**,** [**Skomsvoll JF**](http://www.ncbi.nlm.nih.gov/pubmed?term=Skomsvoll%20JF%5BAuthor%5D&cauthor=true&cauthor_uid=1485290)**. [Injuries following a hurricane in Nordmøre].** [**Tidsskr Nor Laegeforen.**](http://www.ncbi.nlm.nih.gov/pubmed/?term=1485290) **1992 Dec 10;112(30):3777-80. [Article in Norwegian] PMID 1485290]**

These six terms involving hurricane are shown in Table 2 and identified as being in sentence 1. The ideas from sentence 4 for PMID 2372228 also are shown in the Table. These ideas illustrate organization by columns labeled -- Hurricane, Related, Ident and Sentence.

**Table 2. Excerpt of Ideas Dealing with Hurricane.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Hurricane** | **Related** | **Year** | **Ident** | **Sentence** |
| hurricane | authorities | 1992 | 1485290 | 1 |
| hurricane | casualties | 1992 | 1485290 | 1 |
| hurricane | cause | 1992 | 1485290 | 1 |
| hurricane | injuries | 1992 | 1485290 | 1 |
| Hurricane | prevent | 1992 | 1485290 | 1 |
| hurricane | concept | 1990 | 2372228 | 4 |
| hurricane | coping | 1990 | 2372228 | 4 |
| hurricane | disaster | 1990 | 2372228 | 4 |
| hurricane | mechanism | 1990 | 2372228 | 4 |
| hurricane | nurse | 1990 | 2372228 | 4 |
| hurricane | population | 1990 | 2372228 | 4 |
| hurricane | psychosocial | 1990 | 2372228 | 4 |

**Selection of Vocabulary:** Table 1 showed the selection of vocabulary based on the frequency of linkage with the primary term (hurricane). Table 2 showed an excerpt of the ideas extracted from the text based on the vocabulary. The process involved in selecting the vocabulary is the first of the algorithmic approaches. Two measures are considered.

The first is the ***frequency of use of the idea***. The ideas used most often tend to represent a consensus acceptance of relevance given a selected primary term. This relationship is considered to be ***direct***, that is X is used frequently by authors with Y. The second is the ***consistency of use*** across different situations. That depicts another form of consensus where the term is used with different terms linked to the selected primary. This relationship depicts an indirect link with the primary term. That is, Z is related to the set {X} that are, in turn, directly related to Y.

Table 3 shows a summary of the expansion and use of the term-idea identification process. Each column label occurred with high frequency with the primary (hurricane). The ideas associated with each column heading were retrieved and the higher frequency terms-ideas are merged into the table. Table 1 showed the terms linked frequently with hurricane. Table 3 shows the terms (row variables) linked with each respective column variable. Ideas below the level defined as ***higher frequency*** are assigned the value of zero in this analytic table.

**Table 3. Analysis of Terms-Ideas to Identify Vocabulary**.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Term | Hurricane | Disaster | Health | Flood | Experience | Stress | Provide | Mental | Response | Consistency | Sum |
| **health** | **61** | **1100** | **0** | **156** | **295** | **164** | **863** | **1707** | **519** | **8** | **4865** |
| **disaster** | **108** | **0** | **1100** | **138** | **374** | **250** | **608** | **622** | **849** | **8** | **4049** |
| **mental** | **37** | **583** | **1707** | **91** | **161** | **214** | **269** | **0** | **204** | **8** | **3266** |
| **public** | **33** | **306** | **2024** | **77** | **0** | **0** | **288** | **224** | **358** | **7** | **3310** |
| **emergency** | **25** | **477** | **794** | **0** | **328** | **0** | **711** | **209** | **728** | **7** | **3272** |
| **provide** | **39** | **498** | **863** | **78** | **210** | **0** | **0** | **269** | **339** | **7** | **2296** |
| **response** | **36** | **679** | **519** | **70** | **0** | **121** | **339** | **204** | **0** | **7** | **1968** |
| **experience** | **46** | **374** | **295** | **71** | **0** | **166** | **210** | **161** | **0** | **7** | **1323** |
| **medical** | **31** | **578** | **544** | **0** | **195** | **0** | **579** | **0** | **411** | **6** | **2338** |
| **clinic** | **20** | **0** | **318** | **0** | **210** | **0** | **303** | **150** | **108** | **6** | **1588** |
| **management** | **0** | **491** | **293** | **75** | **139** | **0** | **242** | **0** | **144** | **6** | **1384** |
| **nation** | **0** | **318** | **526** | **0** | **97** | **0** | **242** | **171** | **234** | **6** | **1109** |
| **cause** | **25** | **253** | **276** | **199** | **0** | **114** | **0** | **190** | **0** | **6** | **1057** |
| **problem** | **0** | **255** | **575** | **65** | **119** | **0** | **0** | **303** | **0** | **5** | **1317** |
| **stress** | **41** | **260** | **0** | **0** | **169** | **0** | **0** | **235** | **137** | **5** | **842** |
| **person** | **0** | **321** | **415** | **0** | **235** | **0** | **234** | **0** | **135** | **5** | **838** |
| **model** | **20** | **0** | **0** | **142** | **0** | **0** | **188** | **161** | **138** | **5** | **649** |

The two summary measures – ***consistency*** and ***frequency*** -- are shown. Consistency is determined as the number of column variables having ideas with each row label. This measure seeks to determine the number of different situations (i.e., column headings) coupled with each row variable. The maximum value would be the number of column labels. The frequency of ideas (SUM column) is determined by adding the row frequencies across the columns. This measure assesses the global interest in a row variable by subject specialists across the terms linked with hurricane. A relevant subset of terms directly or indirectly linked with the primary (hurricane) would include the higher frequency of use terms (direct links with hurricane) plus the higher consistency of use terms (indirect links with hurricane).

**Verification of Informative Terms and Ideas:** Exhibit 1 shows an example of the verification process using a 2000 publication. The format is as follows:

The source data were given including the identification number assigned by PubMed (PMID). That number makes retrieval rapid and accurate.

The identified sentence(s) were shown with the informative terms highlighted. Each term is identified once within a sentence.

The idea records dealing with that sentence were shown.

Behind each sentence is a ratio giving the number of terms identified by the software relative to the number of terms available for identification. That ratio determines the precision associated with correctly identifying informative terms. The selection of informative terms can be evaluated by comparing the terms selected with those used by the subject specialist-authors. In the sentences in Exhibit 1, terms are color coded to represent different situations. The terms highlighted in red indicate that the software properly selected them. Those in green denote that the software missed them. Terms highlighted in blue were used by the authors, but, were not included in the vocabulary. The blue colored terms may be less frequently used in ideas, be inconsistent, and/or be general in meaning.

**Exhibit 1. Document 10895916 Published in 2000.**

**Source:** [**Wylie T**](http://www.ncbi.nlm.nih.gov/pubmed?term=Wylie%20T%5BAuthor%5D&cauthor=true&cauthor_uid=10895916)**,** [**Cheanvechai D**](http://www.ncbi.nlm.nih.gov/pubmed?term=Cheanvechai%20D%5BAuthor%5D&cauthor=true&cauthor_uid=10895916)**,** [**Seaberg D**](http://www.ncbi.nlm.nih.gov/pubmed?term=Seaberg%20D%5BAuthor%5D&cauthor=true&cauthor_uid=10895916)**. Emergency response team: Hurricane Georges in Key West.** [**Prehosp Emerg Care.**](http://www.ncbi.nlm.nih.gov/pubmed/?term=10895916) **2000 Jul-Sep;4(3):222-6. PMID 10895916**

***Sentence 2: Lower Florida Keys Hospital, which serves Key West and the Lower Keys, had previously been evacuated of inpatients and staff. (2/2)***

***Sentence 3: An emergency response team composed of three emergency medicine (EM) physicians and four EM nurses was sent at the request of the state to maintain emergency department (ED) operations at the hospital. (4/ 5)***

***Sentence 6: Initially, patients requiring hospitalization were evacuated, but as the storm neared, this was stopped. (2/2)***

Ideas in Document 10895916 – Sentence 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Primary** | **Related** | **Year** | **Ident** | **Sentence** |
| patient | hospital | 2000 | 10895916 | 2 |
| hospital | patient | 2000 | 10895916 | 2 |

Ideas in Document 10895916 – Sentence 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Primary** | **Related** | **Year** | **Ident** | **Sentence** |
| **nurse** | **Emergency** | **2000** | **10895916** | **3** |
| **operation** | **Emergency** | **2000** | **10895916** | **3** |
| **response** | **Emergency** | **2000** | **10895916** | **3** |
| **emergency** | **Nurse** | **2000** | **10895916** | **3** |
| **operation** | **Nurse** | **2000** | **10895916** | **3** |
| **response** | **Nurse** | **2000** | **10895916** | **3** |
| **emergency** | **Operation** | **2000** | **10895916** | **3** |
| **nurse** | **Operation** | **2000** | **10895916** | **3** |
| **response** | **Operation** | **2000** | **10895916** | **3** |
| **emergency** | **Response** | **2000** | **10895916** | **3** |
| **nurse** | **Response** | **2000** | **10895916** | **3** |
| **operation** | **Response** | **2000** | **10895916** | **3** |

Ideas in Document 10895916 – Sentence 6

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Primary** | **Related** | **Year** | **Ident** | **Sentence** |
| patient | hospitalization | 2000 | 10895916 | 6 |
| hospitalization | Patient | 2000 | 10895916 | 6 |

While pattern recognition should be 100%, text is prepared using a number of different programs. Some introduce hidden symbols that interfere with recognition. In addition, authors use punctuation in various ways so that the pattern is different from the one being sought. As such, correct recognition can vary from 66% to 100% with a median of 85% across different texts. The term, hospital, was missed by the software in sentence 3. The accuracy score was reduced to 80%. The 6th sentence contained a word – storm – that was not included in the vocabulary. It satisfied the criterion of specificity relative to the topic. It did not satisfy the criterion of frequency. Hence, the software performed correctly.

Once the idea database is operational, the development of learning objectives is efficient because of the ease in arranging the ideas to form different syntheses. The higher frequency ideas provide a consensus description of what’s known at a given time. The lower frequency ideas represent two situations – one depicting the disappearance of ideas with time. The second represents the emergence of new ideas. Temporal analysis can readily identify the two situations.

**Summary**

An initial reaction would be to challenge the veracity of the formal process. By making the analysis transparent and quality-controlled, the needed documentation is readily available. The student, new to the subject, can begin learning by solving problems and by building new idea structures. The ability to acquire, organize, and utilize the ideas enhances the transformation from novice to professional. The need to spend long hours in the library stacks is replaced by a need to spend time thinking and employing the ***legos learning*** approach. Those actions could yield an operational description of critical and creative thinking.

With the ideas organized and usable, students at all levels can build numerous idea structures representing a given topic. This array shifts the focus from a single answer to a spectrum of possibilities each with desirable and undesirable characteristics. Weighing those attributes and developing rationales is an example of the critical thinking process. Translating those functions to transparent, quality-control procedures is an example of the Idea Analysis approach.