

Utilization of Heroin Information by Adolescent Girls in Australia: A Cognitive Analysis

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This article reports on a study that investigates how older adolescents cognitively utilize information on the drug, heroin. With a small group of four girls in their final year of secondary education, the study sought to: (a) establish the perceived effects of exposures to information; (b) establish how the perceived effects are associated with changes to the girls' knowledge structures; and (c) establish any patterns in relation to changes in knowledge structures and perceived effects. The study employed a quasi-experimental, repeated-phase approach. The girls' existing knowledge structures about the drug, heroin, were elicited and mapped, as were knowledge structures after each of three exposures to different information on heroin. The knowledge structures after each exposure were shown to change by cognitive strategies of appending, inserting, and deleting. Five types of effects, as types of cognitive information utilization, were identified, these being: Get a complete picture, get a changed picture, get a clearer picture, get a verified picture, and get a position in a picture. The study also showed that there was coherence between the effects and how these effects were manifested in changes to the girls' knowledge structures. This article also discusses important implications for information practice and instructional design.

Introduction

The high incidence of drug abuse by adolescents and young adults, and its consequences, are acknowledged by many as an important concern in contemporary society. Adolescents and young adults also acknowledge that drugs are an important everyday concern for them (Poston-Anderson & Edwards, 1993). Statistics from many countries bear witness to the seriousness of this problem. In the state of New South Wales, Australia, for example, data from the Health Department Drug and Alcohol Directorate (1993) show that alcohol is responsible for 51% of drug-caused deaths in the 15 to 34 year old age group. Opiate-caused deaths are also highest amongst this age group, accounting for 33% of the total drug-caused deaths (New South Wales

(NSW) Health Department, 1993). The seriousness of the concern is further reflected in the plethora of media and public drug-education campaigns and curriculum-based studies in schools that are designed to provide information to shape the knowledge, attitudes, and values of young people toward a drug-free lifestyle (Wodarski, 1990).

Considerable research exists which has attempted to understand factors contributing to the perpetuation of drug abuse by adolescents, and concludes that it is influenced by a complex interacting network of sociological, biological, and physiological factors (McDonald & Towberman, 1993). It is known, for instance, that the first experience with drugs usually occurs during adolescence (Wolf, Olenick-Shemesh, Addad, Green, & Walters, 1995); that when adolescents perceive their parents' attitude towards substance use is favorable, they tend to use substances at a higher rate; that association with drug-using peers is a strong predictor of adolescent drug use; and that parental absence due to break-ups, death, divorce, or a hostile family environment that creates a sense of alienation, increase the chances that adolescents will abuse drugs (Denton & Kampfe, 1994).

Baran and Davis (1995) assert that in our everyday lives we are exposed to vast quantities of information; yet we ultimately process, utilize, and store only a small fraction of this information, most of which is soon forgotten. This assertion begs the question: What do adolescents do cognitively with the volume of drug information to which they are exposed? Understanding the world of adolescents in relation to how they process drug information is thus seen as an important component of both more holistic theory building in this contemporary problem and in the development of more effective information services that contribute to intervention and prevention of this problem.

Background and Aims

This research builds on two important developments in information science over the last two or three decades. First, a growing focus on a user-oriented paradigm (Dervin & Nilan, 1986) has given emphasis to the "active, construct-

ing, meaning-making human as fundamental to communication phenomena” (Dervin, 1991, p. 61). Secondly, the emergence of a cognitive perspective of information science has provided the field with a meta-theory about the user as a seeker and interpreter of information, where the primary theoretic object is people’s structures of knowledge located “inside the mind of the organism” (Belkin & Robertson, 1976, p. 203).

In building on these developments, this study sought to investigate the cognitive construction of adolescents when they are exposed to information about the drug, heroin, from the perspective of the adolescents. Many studies have investigated adolescent information seeking, providing important insights into search processes (e.g., Kuhlthau, 1993; Latrobe & Havener, 1997; Moore & St. George, 1991). Some limited studies deal with information about concerns such as drug usage, health, careers, and unemployment, as well as evaluating the impact of information-provision programs on behaviors related to these concerns (Buysse, 1996; Edwards & Poston-Anderson, 1996; Makkai & McAllister, 1990; Mayton, Nagel, & Parker, 1990; Mirzaee, Kingery, & Puitt, 1991). With some exceptions, the studies have not been from the perspective of the adolescents themselves, and have tended to use quantitative structured data-collection methods. Considering the plethora of drug-information programs and statistics on the extent of drug abuse and its consequences leads one to ask: What happens in the minds of these young people when they are exposed to drug information? What do they do cognitively with this information? How does it change what they already know? What are the effects of this information exposure? Accordingly, this study sought to:

- (1) establish the effects of exposure to information about heroin perceived by the adolescents;
- (2) establish how the perceived effects are associated with changes to their knowledge structures; and, on the basis of (1) and (2)
- (3) establish the patterns, if any, within and between the adolescents in relation to changes in knowledge structures and perceived effects.

Cognitive Information Utilization

Central to this study is the concept of cognitive information utilization. The study of information utilization in information science is an active area of academic inquiry that has emerged from several different traditions, including sociology of knowledge, applied social science research, and organizational change. The multiple theoretic perspectives have generated substantive inconsistency and confusion in terminology, problems of definition, diverse methodological approaches, conflicting findings, and empirical generalizations (Dunn, 1983; Larsen, 1985; Karapin, 1986; Rich, 1991). Against this diversity, the literature as a whole conveys the sense that information utilization is all about people and information coming together; it is about people

doing something with information that they have sought and gathered themselves or that is provided for them by someone else.

Two broad perspectives of “doing” can be identified. First, information utilization is portrayed as acting, a behavioral “doing.” This perspective has placed emphasis on end-states, the overt, tangible impacts of recorded knowledge in settings of public policy, organizations, and professional practice (Booth, 1990; Holzner & Fisher, 1979; Leviton & Hughes, 1981). Underpinning this perspective are the assumptions that the information is relevant and will improve the wisdom of decisions, and that action will result from its presentation. The empirical investigation of information utilization as end-state has given rise to the notion of instrumental utilization, describing the physical changes in practice and procedures, actions and outcomes which are a direct result of applications of information (Hultman & Hörberg, 1995; Hutchinson, 1995; Sunesson & Nilsson, 1988).

Second, and more recently, there is the portrayal of information utilization as a complex evolutionary and interactive process. This more holistic view, while taking into account behavioral change, embeds the notion of cognitive change as a central concept and presents people as active, selective, constructive and reflective agents in utilizing information. As interactive change, information utilization implies a process of exposure, selection, adaptation, reinvention and modification of information to fit people’s needs and situations. It involves cognitive and affective processes, and cognitive actions, as well as overt, observable behaviors and actions (Backer & Shaperman, 1993; Holzner & Fisher, 1979; Hutchinson, 1995; Karapin, 1986; Weiss, 1979). The investigation and measurement of information utilization as cognitive change has given rise to research findings and generalizations centering on conceptual utilization (Hutchinson, 1995; Weiss, 1977), describing the changes in the way people think about the world.

A motivating perspective for this study was the Fundamental Equation of Information Science posited by Bertram Brookes, commonly expressed in his writings in a mathematical format as: $K[S] + \Delta I = K[S + \Delta S]$ (Brookes, 1980, p. 131). Brookes believed that the “theoretical” pursuit of information science should be the interaction between the private inaccessible thoughts and mental images of people, and the public documented artifacts of knowledge. He posited the equation to express this interactive process of what people already know ($K[S]$), how what they know changes ($K[S + \Delta S]$) through selectively taking in information (ΔI). Central to this study are concepts of underlying knowledge structures and the change effects of integrating information, as identified by Brookes. While Brookes was skeptical of peering into other people’s minds, he did suggest that there was a need for “. . . experimental or observational knowledge structures and information inputs. We then have to observe what happens, measuring the effects as well as we can, at first in simple cases and then in more complex cases as we develop skill on our technique and confidence in our theories.” (Brookes, 1975, p. 48).

Research Methodology

Selection of Participants

It was decided that it would be more advantageous to follow a small group of adolescents and work with them in-depth to gather rich, detailed data. Working with a small sample acknowledges that transferability and application beyond the group studied are tentative; however, it was felt that the well-grounded, rich descriptions and explorations would provide a strong basis for further hypothesis development and empirical examination. Borg and Gall (1983) suggested that a study that probes deeply into characteristics of a small sample often provides more knowledge than a study that attacks some problem by collecting only shallow information on a large sample.

Given the extensive range of frames of reference which shape the utilization process and which make interpretation difficult, the study imposed some controls on the selection of sample. The data were obtained from four girls in their final year of schooling at a regional, non-selective Catholic secondary school in Sydney, Australia. Students in this school typically come from lower to middle socioeconomic backgrounds. The girls were not randomly selected. They were all aged 17 years, had above-average academic records, and described themselves as motivated learners. At a practical level, representing knowledge structures is dependent on language. The girls were selected on the basis of high levels of English fluency, which enabled them to communicate their ideas effectively for the purposes of the research. They came from Italian, Filipino, Anglo-Celtic, and Arabic backgrounds. Diversity of backgrounds was considered important to maximize variations in cognitive portrayals and to identify possible theoretical boundaries of change, rather than providing just one cultural perspective on cognitive change.

Design

A quasi-experimental approach was used to collect the data. The design framework was a repeated A – B design, where the A phase involved baseline measures of the girls' knowledge, the B phase involved the introduction of staged exposures to information, and changes noted. This A – B pattern was repeated three times, with no variation of treatment procedure.

Approaches to Knowledge Elicitation and Acquisition

Most approaches to eliciting and acquiring the private, subjective knowledge of an individual focus on verbalizations, either written or spoken. Taking a cognitive perspective assumes a strong relation between cognition and discourse, where discourse functions as a lens through which changes to current cognitive states can be observed and measured. This assumption has been challenged by Talja (1997) and Tuominen and Savolainen (1997), who argue

that the way in which a version of information is constructed depends on the interactive or argumentative context of talk, as well as on the pragmatic social purposes this version is designed to accomplish.

There are a number of ways in which information is commonly acquired for knowledge representation purposes, including unstructured and structured interviews, familiar-task methods, constrained processing tasks, tough-cases methods, and observation studies (Belkin, Brooks & Daniels, 1987; Gordon, 1992). A combination of free-generation written discourse and question answering protocols through a semistructured interview was chosen to elicit the knowledge of the girls. There is evidence to suggest that the combination of these two approaches is a very informative first step in uncovering and exploring the content of a particular knowledge base (Graesser & Clark, 1985).

Context of the Study

The setting for the study was a school environment and a curriculum-centered task. The specific topic centered on the drug, heroin. A time limit was imposed on each sequence of exposure to further reflect a school environment. The successive exposures to information, were each expected to take 50 minutes, a time frame representing the length of a school timetable subject period, and a time frame in which the girls were accustomed to working.

Focus Problem

A hypothetical task, drawn from the NSW curriculum "Personal Development, Health and Physical Education," was developed for the girls to focus on and set realistic boundaries on this content:

Your local council is concerned about the increase in drug usage in the area, and has approached high schools to participate in a public forum. The public forum will focus on factors associated with harm from drug use, and consequences of harmful drug use on the individual, and making health-related decisions. You have been selected by your school to present a talk, accompanied by a written guide, at the forum that specifically deals with heroin. Your topic will focus on nature and incidence of the drug, implications for the individual, and implications for the community.

Given the sensitivity of exploring people's knowledge of drugs, procedures were set in place to ensure that there was no breach of ethics. The girls were in control of both how much information, and the specific information content, that they provided. Accordingly, the girls were not questioned on their use of heroin or attitudes towards heroin before the exposures.

General Procedure Plan

The following procedure plan was adopted:

- (1) acquire and map baseline knowledge structure (KS0) of each girl
- (2) exposure to Information (I1)
- (3) acquire and map baseline knowledge structure (KS1)
- (4) exposure to Information (I2)
- (5) acquire and map baseline knowledge structure (KS2)
- (6) exposure to Information (I3)
- (7) acquire and map baseline knowledge structure (KS3)
- (8) debriefing and discussion

Within this plan, time was made available for the girls to read and reflect, as well as for refreshment breaks.

Operationalization of Exposure to Information

Exposure to information was defined as the act of disseminating messages in the hope that they will be read and thoughtfully considered. It was manipulated in terms of predetermined amounts of different, publicly available information presented as printed text at predetermined stages during the process. This information was consolidated from three sources authorized by the Centre for Education and Information on Drugs and Alcohol in New South Wales (CEIDA) (Byrski, 1986; CEIDA, 1989, 1990). The sequence of exposures was: (1) botanical nature and history of the drug, heroin, including its history in Australia; (2) implications of heroin use for the individual, with particular emphasis on the physical and psychological effects; and (3) implications for the community, including approaches to treatment and recovery.

Data collection took approximately five hours for each girl. The free-generation phase involved the girls writing down whatever they knew about the drug, heroin, in the context of the hypothetical task provided. At the completion of the written response, the written transcripts were examined to identify areas for probing during the interviews. In the question answering phase, the girls answered a set of how, when, where, why, and what questions based on their written responses. These were audiotaped. This questioning helped to make implicit knowledge explicit, ensured that the linkages between ideas were represented accurately, provided a greater richness to the data, and validated the written ideas. A debriefing session elicited responses about the impact of the information exposures and the changes it brought on.

The outcome of these procedures was a set of written and oral responses that collectively formed the knowledge of each girl prior to the information exposure, and after each exposure to information, as well as a set of statements related to the effects of the exposures. These responses formed the basis for the researcher to operationalize knowledge structures, and then to undertake the data analysis to address the specific research aims.

Data Preparation and Analysis

There are many approaches to representing and operationalizing knowledge structures which are said to approx-

imate the true knowledge structures a person possesses. These capture general structures, specific structures, structures of meaning, argument structures, discourse structures, and structures for different kinds of knowledge, such as procedural and declarative knowledge. A network approach known as Conceptual Graph Structures based on Graesser and Clark (1985) and derived from Sowa (1984) was used to represent the girls' declarative knowledge of heroin. A Conceptual Graph Structure is a graphical representation consisting of self-contained units called statement nodes interrelated by a network of relational arcs. In this study, the unit of knowledge was a proposition, a description of a state, event, goal, or a style which expressed a complete thought. It was operationalized as a sentence or string of words that contained at least two concepts linked together to form a meaningful unit expressed in the natural language of the girls. Statements acquired through the verbal protocols were combined with the free generation statements during the transcription process to create a series of conceptual graph structures that represented a complete interrelated picture of each girl's declarative knowledge at each stage of the information exposure. The structures were drawn using the computer software "kMap," a simple and expedient graphical organizer, (demonstrated at the web site: <http://ksi.cpsc.ucalgary.ca:80/articles/WWW/WWW4WM/>) (Gaines & Shaw, 1995). The linkages as portrayed were operationalized by specific language relations either specified by the girls, or clarified through the verbal protocols.

The data were analyzed qualitatively, and in three phases. Phase 1 focused on establishing the perceived effects of the information exposures using an analytical inductive approach based on constant comparative method (Glaser & Strauss, 1967) to code the girls' statements and build conceptualizations of effects and changes to structures (Aim 1). These were coded by the researcher on three separate occasions, and with the assistance of an experienced qualitative researcher in constant comparison approach. This was done to check the stability and plausibility of the categories over time, and to deal with problematic indicators. In this repeat process, there was substantial agreement as to the categorization of the indicators; the third attempt dealt with the remaining small number of indicators where there was some difficulty (11 of 152 statements).

Phase 2 focused on identifying and conceptualizing the changes to the girls' knowledge structures (Aim 2). A change in structure was defined as an alteration to the initial structure in some way. It was characterized as *how*, i.e., understanding the cognitive strategies operating on knowledge structures to bring about the revised structures; and in terms of *what*, i.e., describing the nature of the revised knowledge structures resulting from the cognitive strategies. This involved systematically comparing the structures across the different exposures, and documenting all specific instances of changes to structures. The study did not examine the cause of changes, whether the changes were random or aspects of other ongoing changes, and acknowledges the

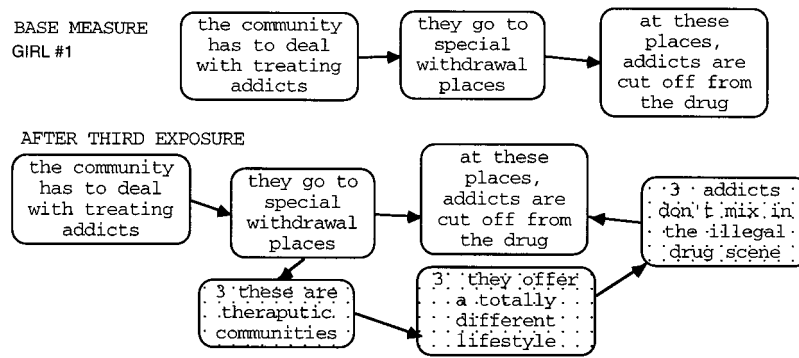


FIG. 1. Change in knowledge structures.

implications this may have on measuring or filtering out error or random changes. However, the use of the verbal protocols provided opportunities to probe the recorded changes.

Phase 3 focused on establishing how the perceived effects of the exposure to information were manifested in changes to each girl's knowledge structure (Aim 3). This involved several strategies including linking a perceived effect to a specific knowledge structure, isolating the conceptual graph structures for these content areas at each of the stages of the exposure, and identifying the specific change(s) to the conceptual graph structures. Figure 1 illustrates a conceptual graph structure and provides an example of a change in structure. In this example, the existing knowledge consisting of three propositions has been extended by a further sequence of three propositions (shaded) after the third exposure. The number indicates first, second, or third exposure.

Findings

The Cognitive Strategies

Three generic cognitive strategies were used by the girls to change their knowledge structures. These were appending, inserting, and deleting (Fig. 2).

The Perceived Effects

The girls acknowledged that their working with the information in the exposures had effects, and they were able to articulate these quite specifically. In the first instance, effects tended to be described as "picture," for example: "it broadens the picture" and "gives me an expanded picture." One girl further remarked: "In my mind I have scenes, images, many of them. I've described the pictures I've seen with word." Accordingly, the conceptualizing and labeling

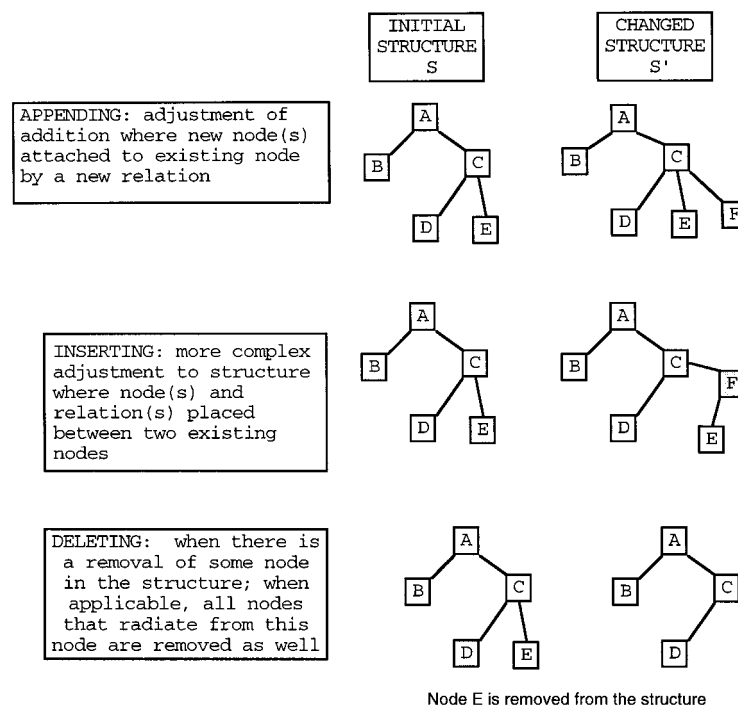


FIG. 2. Cognitive strategies (Based on Graesser & Clark, 1985).

TABLE 1. Summary of findings.

Type of cognitive information utilisation	Types of changes in knowledge structures	Predominant cognitive strategy
Get a complete picture (43 statements)	(a) Inclusive (b) Elaborative <ul style="list-style-type: none"> ● property-oriented structures ● manner-oriented structures ● cause-oriented structures ● goal-oriented structures (c) Integrative	Primarily appending (53 instances), with some inserting (11 instances)
Get a changed picture (28 statements)	(a) Construction (b) Deconstruction (c) Reconstruction	Initially appending (50 instances), then deleting (20 instances) then appending
Get a clearer picture (24 statements)	(a) Explanation <ul style="list-style-type: none"> ● Tells how ● Tells why (b) Precision	Inserting (15 instances) and appending (12 instances)
Get a verified picture (17 statements)	(a) No change (b) Emphatic (c) Inclusive (d) Defensive	Primarily appending; in several cases, no change processes appear to be operating, with no changes identified
Get a position in a picture (29 statements)	(a) Reactive (b) Formative (c) Potential positioning (d) Predictive	All appending

of these perceived effects were based on the “picture” metaphor.

The analysis of the girls’ 141 statements about their perceptions showed that they perceived five effects of exposures to information: (1) get a complete picture; (2) get a changed picture; (3) get a verified picture; (4) get a clearer picture; and (5) get a position in a picture. Table 1 presents an overall summary of findings. It shows the type of cognitive information utilization identified and number of statements associated with it, the predominant cognitive strategy, and the characterization of the types of changes in the knowledge structures.

Get a Complete Picture

“Get a complete picture” was derived from 43 indicators that collectively suggested the girls utilized the information to build an expanded, more complex picture. It was reflected in statements such as: “it spells out all the side effects in detail. I learned many specific effects I didn’t know” and “the information put specific amounts on the fines and sentences.”

From the indicators, “get a complete picture” appeared to take place in four ways. First, by expanding general statements by more specific detail, for example: “I wasn’t aware before of all of the forms and details of treatment.” Second, by adding new facets or dimensions to an existing idea, for example: “I get a more complete picture: That’s an expanded picture: You know more about an idea and what is related to it, for example, the reasons why people take drugs.” Third, by making links between some of their knowledge about heroin, and other knowledge that existed

elsewhere in their minds, but was not related to heroin, for example: “I was able to relate what I thought at first were unrelated ideas, for example, heroin, opium, and morphine.” Fourth, the girls suggested that the information acted as a trigger to remembering and recalling ideas that already existed elsewhere in their minds that they hadn’t thought of at the time, for example: “it triggered other information I already knew; the information was not remembered the first time around, such as my grandmother on morphine.” What was also evident was their ability to add not just single facts here and there to existing knowledge to expand it, but also to take in substantial amounts of information. This was reflected in comments such as: “learn whole new blocks of information—I didn’t know anything about the history of the drug.” Cognitive information utilization, as the effect “get a complete picture” was in part a process of constructing new knowledge, and in part a dynamic process of making explicit links to recalled knowledge. While it could be argued that all of the perceived effects described in this study ultimately resulted in an expanded picture, a complete picture for the girls was in the more immediate sense of building up an expanded picture about heroin.

For all of the girls, appending was the primary cognitive change strategy associated with “get a complete picture” (57 instances). Inserting was a secondary and comparatively minor strategy (11 instances). This pattern was consistent with all of the girls.

The effect of “get a complete picture” was manifested in revised knowledge structures that were shown to be more *inclusive*, *elaborative*, and *integrative*. A more *inclusive* knowledge structure resulted when the girls added specific instances, examples or types to more general propositions,

AFTER SECOND EXPOSURE

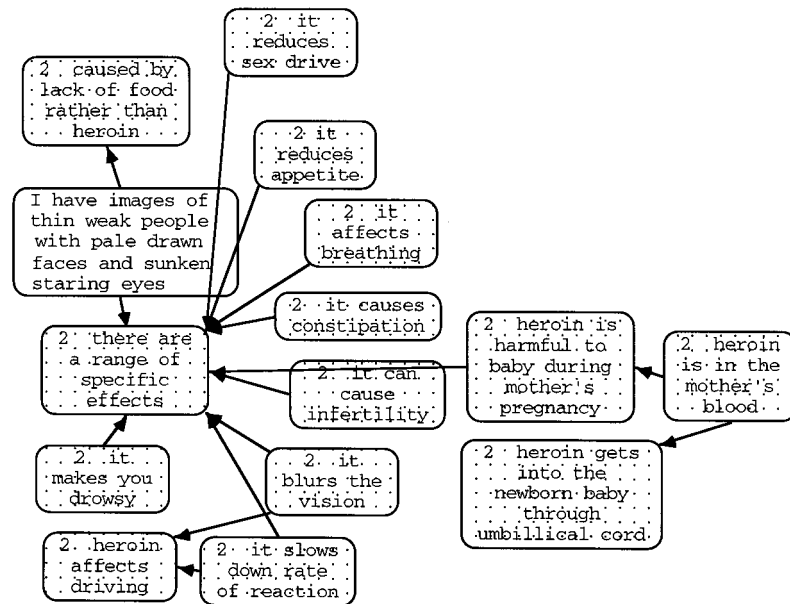


FIG. 3. Get a complete picture showing inclusive knowledge structure.

building more detailed and more comprehensive descriptions. It was shown in the revised knowledge structures as new specific nodes being linked to more general nodes through the relation "is a," an expression the girls used frequently. For example, as shown in Figure 3, Girl #2 indicated that "the new information gives me specific examples to work with, such as examples of the specific effects." In the associated knowledge structure, the node "there are range of specific effects" was expanded by including nodes such as "it affects breathing," "it can cause infertility," and "it reduces appetite." At a more abstract level, a general class "effects of taking heroin" was expanded by stating specific inclusions, such as "it reduces appetite." The initial knowledge structure was changed from a general structure to a structure that showed greater specificity and precision of ideas through the hierarchical building of set membership.

The second type of revised knowledge structures associated with "get a complete picture" was a more elaborative knowledge structure. This structure resulted when existing nodes were expanded by defining them, and/or describing their characteristics, processes, styles, and causes. More elaborative knowledge structures contained associative relationships rather than hierarchical ones. Four types of elaborative knowledge structures were identified. These were:

property-oriented structures that showed static properties, features or attributes of previously existing knowledge such as quantity and size, and were built on "has" and "contains" relations.

manner-oriented structures that showed how an action occurred, and/or specified a process, or outlined a style.

cause-oriented structures that described events' chain structures, outlined causally driven mechanisms and de-

scribed consequences. The relations in these structures tended to embody "results in," "enables," and "leads to." *goal-oriented structures* that elaborated goals, reasons, outcomes, and desired events/states. The relations in these structures tended to be reasons.

In a small number of cases, some of the revised knowledge structures showed the linking of separate structures that existed earlier. The outcome was both more expanded knowledge structures and more integrated knowledge structures.

Overall, there were some patterns evident among the girls. For all the girls, the primary change to the knowledge structure to "get a complete picture" was made through appending. While insertings were also employed, appendings substantially outnumbered insertings. For all the girls, the changes of structure could be characterized chiefly as elaborative and inclusive, with a small number of integrative changes. Elaborative knowledge structures were the most common type of revised knowledge structure, followed by, in order of frequency, inclusive and integrative. The changes of structure through inserting were all elaborative and integrative changes. These appeared to occur equally among the girls. For all the girls, there was a sequence of change activity to "get a complete picture." Some changes brought about by appending and inserting did not work in isolation. When the initial changes, through appending, were inclusive changes, these often led to elaborative changes, and in a small number of cases to integrative changes. These occurred at the time of exposure and after other exposures; where the initial changes were elaborative changes, these often led to integrative changes. Elaborative changes through inserting in most cases also led to integrative changes.

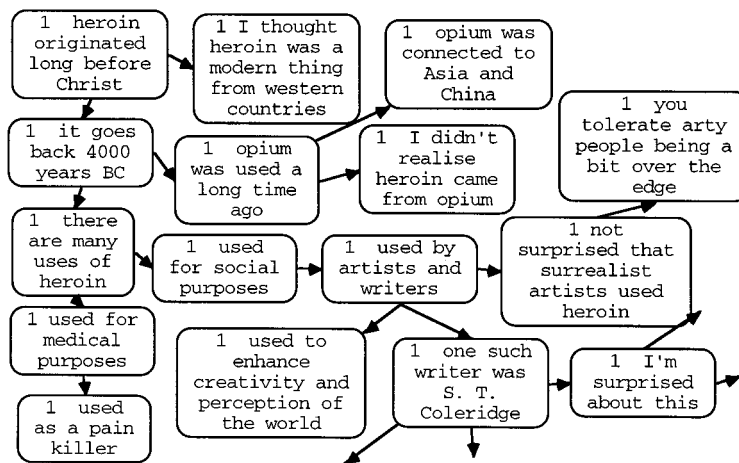


FIG. 4. Get a changed picture.

Get a Changed Picture

As shown in Table 1 the girls provided 28 indicators of utilizing information to make changes to their existing ideas. “Change” was often mentioned by the girls, in comments such as: “I’ve changed my mind many times— new facts that show some of my facts were wrong”; and “I found some of my ideas were wrong, so I changed them.” “Changed” in this context was where the information exposures enabled them to determine that existing ideas were incorrect or inappropriate and remove them from the picture. Some matching of existing ideas against the information appeared to take place. The indicators also showed that in some instances, removing an incorrect idea was accompanied by replacing it with a new or modified, correct idea.

While “get a changed picture” was primarily seen in relation to correcting specific facts, the girls also provided some evidence of a wider notion of getting a change in perspective rather than just a change in facts. For example, Girl #3 commented that “the baby image isn’t a good one, this is wrong, given what I’ve read about the calming effects.” Here she was commenting about a set of statements which compared the process of treatment to that of removing a pacifier from a baby. The image of a screaming baby, in light of the information, was not considered to be “a good one,” and was subsequently deleted.

In order to “get a changed picture,” the girls appended (50 instances) and deleted information (20 instances), and to a lesser extent, inserted information (three instances) into their existing knowledge. This pattern appeared to be consistent between all of the girls. These did not work as isolated strategies, rather, appending and inserting were often a prelude to deleting, which according to the girls was the primary cognitive strategy. These changes worked together to build the changed picture. Figure 4 illustrates a part of this changed knowledge structure.

In this example, the exposure to information enabled the judgment to be made that the starting node was wrong, and it was subsequently deleted. A new starting node “heroin

originated long before Christ” replaced this deleted node. With this new node was appended an acknowledgment that the original knowledge was changed “I thought heroin was a modern thing from western countries,” in essence, verifying the replaced node. The effect of this change was then being able to append a complex structure of 64 nodes related to the historical origins of heroin.

The analysis showed that existing knowledge structures appeared to go through three stages of revision, conceptualized as “construction,” “deconstruction” and “reconstruction.” In order to “get a changed picture,” the girls first appeared to utilize the information to build up a more detailed, descriptive picture. This process of construction was primarily through appending inclusive and elaborative structures. The outcome was often the acknowledgment that some propositions were “wrong” or “not correct” or “opposite,” for example: “I had always associated using heroin with violence. This is not correct.” In a number of indicators the girls appeared to verify that their existing ideas were wrong, for example: “I had thought previously that treatment was done through media campaigns. Wrong again!” In a small number of cases for each girl, the information did not appear to first bring on a constructive change of building a complete picture; rather, there was an up-front acknowledgment that a proposition was incorrect, and it was deleted.

The second phase of “get a changed picture” was a change conceptualized as “deconstruction.” Here, the problematic concept(s) or proposition(s) were removed by deleting, and this appeared to take place in two ways. The first was by removing a complete proposition. For example Girl #4 said “I always thought heroin was a recent modern discovery. I didn’t realize it goes back a long time.” Her initial knowledge of the nature of heroin consisted of one node “heroin is a modern drug of young people today.” In the following knowledge structure this was deleted and replaced with a new starting node “heroin is prominent in history.” In some cases, more than one node was deleted. This was where nodes attached to the incorrect node were

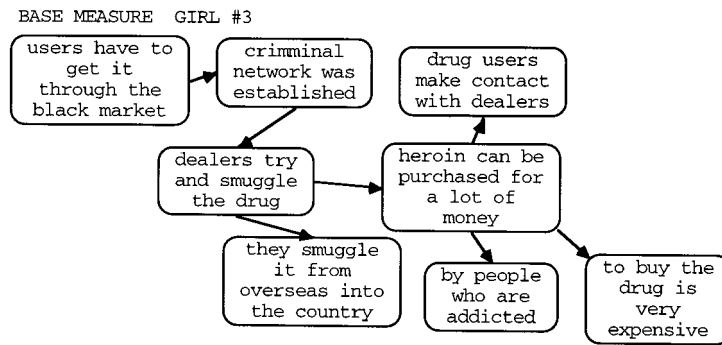


FIG. 5. Get a clearer picture.

more inclusive nodes of that incorrect node, that is, they provided set membership details. The second type of deleting was the removal and subsequent replacement of a component of a proposition, resulting in a new proposition that was a modification of the existing one. For example, Girl #1 removed the statement “there might be a change of personality” and replaced it with “it delays the maturing of the personality.” In this example, she appeared to recognize that heroin had an effect on personality. The unstated concept of “effect” was retained, but the level of the effect was modified from “a change of” to “delays the maturing of.”

After deleting, there was evidence that the girls utilized the information to rebuild and/or further extend their pictures. This rebuilding or extending was conceptualized as “reconstruction” and was almost always brought about by appending, with a few instances of inserting. Once an incorrect node had been deleted, it was often replaced by another node in the same position as the deleted node. This replaced node, derived from the information exposures, was the starting point for substantial appendings that extended the knowledge structure, resulting in other effects, such as “get a complete picture” and “get a position in a picture.”

Get a Clearer Picture

All the girls utilized the information to “get a clearer picture.” Twenty-four indicators of this effect were evident in the data, with the first and second exposures related to the origins and nature of heroin providing the most and the third exposure providing the least number of indicators. Given the small numbers however, it is emphasized that the patterns are indicative of trends only.

In the debriefing session, the girls made comments such as: “it gives more reasons for something; makes a stronger argument; it explains” and “it clarified some of the general statements I’ve made, like how methadone reduces addiction. It explains things.” In these indicators, the girls appeared to suggest that the information shed more light on their ideas so that the ideas could be seen more clearly, with greater understanding and clarity. Such statements tended to be followed by a sequence of ideas which provided the details of clarification and explanation. In some cases, the

girls said that the exposures enabled them to sort out, organize and sequence their ideas more meaningfully; in other instances the information enabled them to resolve confusions and indistinctions, thereby providing clarification.

In order to “get a clearer picture,” the girls primarily inserted (15 instances) and appended nodes (12 instances) into their existing knowledge structures. Two types of revised knowledge structures were evident. One type showed changes providing explanations of how and why, and the other showed precise details and examples of set membership, and elaborative details such as properties.

The girls consistently inserted nodes in order to tell “how” or “why” their ideas were related. These nodes were explanatory in purpose. They added greater clarification and understanding to the girls’ ideas by providing explanation. “How” explanations resulted in cause-oriented nodes being inserted. These nodes tended to present a linear sequence of intermediate events or states linked by “results in,” “enables” or “leads to.” “Why” explanations resulted in goal-oriented nodes being inserted. These sequences showed desired states or events, and reasons for them. This is illustrated in Figure 5 by Girl #3, who shows part of her knowledge structure on the nature and origin of heroin. In this case, the indicator for “getting a clearer picture” was “it clarifies an idea. For example, explaining why the criminal network in Australia grew.” Her knowledge structures showed that after the first exposure she inserted a sequence of nodes to provide an explanation of how, why, and when the criminal network was established in Australia. This insertion took place between the nodes “criminal network was established” and “dealers try and smuggle the drug.” It consisted of nodes related to the background of the criminal network, and the girl’s argument for it. Some factual evidence for the initial proposition was also provided, and she established “dealers try and smuggle the drug” as the conclusion to her argument.

In some cases, “get a clearer picture” was associated with knowledge structures that showed precision and specificity of ideas through building up set membership details or specific property/attribute details. Consequently, the appended substructures tended to be set membership or prop-

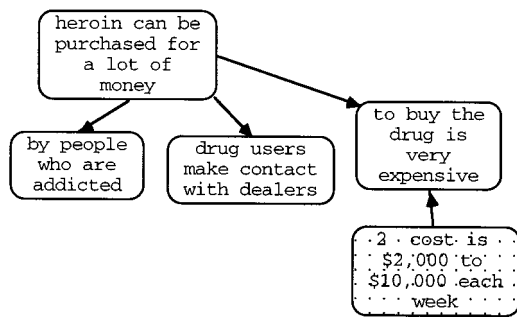


FIG. 6. Get a verified picture.

erty substructures. While these revised knowledge structures could technically be classified as inclusive and elaborative structures associated with “get a complete picture,” in the context of their development the girls associated them with getting clarifications and explanations.

Get a Verified Picture

The conversations with the girls made it apparent that they were able to utilize the information to verify existing ideas, especially where some doubt existed in their minds about their certainty, and even though on the surface the ideas appeared stated as certain. In doing so, this enabled them to remove doubt about, or establish with more surety, an existing idea. This effect was labeled “get a verified picture.”

All the girls indicated that they utilized information in order to verify aspects of their existing knowledge, although the extent of doing this was less than the other perceived effects. This was illustrated in comments like: “it confirms some of the guesses I’ve made, like when I started writing the first time, you think you know something but are not certain and then the information tells you that it is” and “it confirms what I already know, especially when you think you know something though you’re not feeling 100% certain.”

The analysis of the revised knowledge structures showed that the girls predominantly appended information to “get a verified picture.” Inserting was less common than appending. In several instances, there was no evidence of any change to the girls’ knowledge structures.

Four types of revised knowledge structures have emerged. These were labeled: no change, emphatic change, inclusive change, and defensive change. It is acknowledged that these conceptualizations are tenuous, being derived from a few instances. An example is shown in Figure 6.

This example was associated with the indicator “it confirmed that heroin is expensive to buy.” The effect of getting a verified picture was brought on by appending the node “cost is \$2,000 to \$10,000 each week” to the node “to buy the drug is very expensive.” In this case, the effect “of get a verified picture” is associated with a change in structure where more specific detail is added.

In some cases, a perceived effect was not associated with any change to knowledge structures. For example, Girl #1 indicated “it confirmed that it [heroin] cost a lot.” There is no specific language evidence to show that her knowledge structure changed during any of the exposures to information, even though an effect was perceived. One possible explanation for this might be that in her mind, she had some doubts about the cost, yet tentatively, though explicitly, stated that heroin was an expensive drug. Another possible explanation might be that she actually knew that it was expensive, and the figures provided a level of higher certainty pointing to the prior, unchanged concept.

In a number of knowledge structures of the girls, there was repetition of nodes which appeared to be used to add weight or emphasis to a particular statement, primarily personal statements, perhaps providing “higher” certainty. For example, Girl #2 stated that an effect of the information was “it strengthens my ideas— like the importance of drug education.” Her knowledge structures showed repetition of the notion that the most effective approach to dealing with the problem of drug addiction was the process of drug education. It appeared first in a structure built around detoxification as a form of treatment, then later in a structure built around therapeutic communities as an approach to treatment, and then reoccurred as “further drug education is needed” in a structure that dealt with the penalties for drug use.

In a few instances, some of the revised knowledge structures associated with the effect “get a verified picture” showed the inclusion of specific detail. Verification was shown through appending more precise, specific ideas, that is, specifying the members of a more inclusive class. Likewise, in a few instances, a change of facts encouraged the girls to defend and reaffirm a viewpoint based on the facts before they were changed in their knowledge structures. Overall, “get a verified picture” might be seen as a continuum of verification: sometimes for the girls it meant moving from doubt to certainty; sometimes it enabled them to confirm their existing knowledge; and sometimes it strengthened their belief in their existing position or knowledge and reinforced their standpoint.

Get a Position in a Picture

As shown in Table 1, all the girls provided evidence that the information enabled them to form an opinion or state a viewpoint. This effect was conceptualized as “get a position in a picture.” Twenty-nine indicators were provided, with Girl #2 providing over half (17). This was also the highest number of the indicators for any of the effects. Girls #1, #3 and #4 provided only small numbers of indicators.

The girls indicated that they utilized the information to express an opinion about the pictures they had built up, or to state a view or estimation of their pictures, either as a personal value judgment, a guess, an inference or as an intellectual conclusion. They made comments such as: “I was surprised that artists and poets used heroin. I didn’t

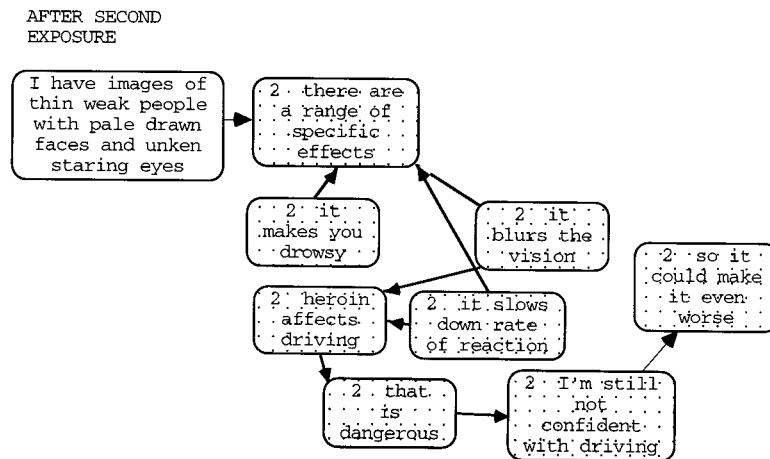


FIG. 7. Revised knowledge structure showing a predictive change.

think that they would be able to think logically as it affects their brain cells” and “helps me express an opinion based on fact.” “Get a position in a picture” was all about taking a stand; being able to take ideas to an end point; being able to derive and state conclusions; being able to see multiple perspectives based on the existing ideas; and being able to look over a set of ideas and offer some reflection on them, such as express agreement or disagreement, or propose a potential course of action. The knowledge structures thus became personalized through the girls leaving their personal stamp on the ideas. Almost all of the changes to their knowledge structures associated with this effect were by appending.

The changed knowledge structures associated with “get a position in a picture” were conceptualized as: Reactive, formative, predictive, and potential positioning. It is again acknowledged that these conceptualizations have been derived from a small number of cases.

In reactive knowledge structures, position statements were appended that expressed a reaction, generally by agreeing or disagreeing with some of the ideas that they had incorporated into their structures. This was often accompanied by statements showing amazement, surprise, or astonishment at these ideas, for example, “I was surprised that” In these cases, there seemed to be acceptance of the ideas, but also a recognition that these facts were not necessarily the expected facts.

In a small number of instances, the revised knowledge structures showed a formative change. This was where they stated a personal conclusion based on the facts provided in the exposure. In a few cases, the revised knowledge structures provided no evidence of a statement of a position associated with the effect, with no position statements appended nor inserted, even though other changes were made to the structure. However, the indicators tended to acknowledge the potential to be able to use the set of facts and their relations in some future time to construct a case or an argument or put them to some other use. The collected set of facts represented a knowledge base for future, potential

positioning. In a very small number of instances, the revised knowledge structures presented position statements where new events and states were predicted; the existing facts were used to state a position, and the circumstances of that position were used to predict further impacts.

The example by Girl #2 in Figure 7 shows revised knowledge structures with both predictive and reactive changes. The indicator of the effect was “I can draw a conclusion, e.g., heroin and driving.” In the analysis of the revised knowledge, structure based on the specific effects of heroin, the effect was brought on by the appending of facts to first “get a complete picture,” from which the position statement was derived, and then appended. It was expressed in the sequence: appending → get a complete picture → appending of position statement.

Conclusions and Discussion

Within the limits of the group, quasi-experimental approach, and procedures employed in this study, a number of types of effects were perceived by the girls in relation to utilizing the information in the different exposures. These types were manifested in distinct patterns of changes to knowledge structures. There was coherence between the effects, and how these effects were manifested in changes to the girls’ knowledge structures.

The five types of effects appear to support some of the information utilization constructs already established in the knowledge utilization literature. They reflect the range of utilities or helps conceptualized by Dervin and colleagues, as shown in the following comparative examples with Dervin’s study of patient–doctor interviews (Dervin, Harlock, Atwood, & Garzona, 1986, p. 602): “Get a complete picture” and “got instructions, facts” and “got answers to questions”; “get a changed picture” and “got new/alterd specified pix” and “got new/alterd general pix”; “get a clearer picture” and “could see the road ahead”; “get a verified picture” and “reaffirmed my direction/ideas”; and “get a position in a picture” and “acquired position.”

"Picture" has also been established as an organizing construct in Dervin's studies, a notion that appears to have been first developed by Carter (1974). In the present study, the choice of the label "picture" was not because it fitted with existing research; rather it fitted with the girls. It was their construct. In particular, they commented on the dominant role of visual media in shaping their existing knowledge of heroin, and made many references to television images of drug addicts they had seen. What is emerging across these studies is a common metaphor of people utilizing information. The picture metaphor may be useful in developing a conceptual taxonomy or model of cognitive effects, and the constructs presented in this study could serve as a potential framework for integrating this diversity.

Overall, the predominant change to the girls' knowledge structures was through elaborating a more inclusive, general idea through set membership; providing more specific layers in the hierarchy of ideas. Knowledge structures that were changed to incorporate set membership were associated with a number of different types of cognitive information utilization. Specific facts seemed to have been important to the girls in constructing their revised knowledge structures, and these facts appeared to play different roles at different times in the utilization process. The implication is not that adolescents should be immediately swamped with facts about drugs as is often the case, in the hope that providing the specific facts might provide the needed pictures or cognitive effects. Rather, information providers need to focus on the desired cognitive effect, to understand how it is best met for each person, and to have available the detailed factual information required to achieve this.

The effects as the girls perceived them were not static; rather, they seemed to be part of an ongoing movement. An overall pattern seemed to be "get a complete picture" → "get a changed picture" → "get a clearer picture" → "get a position in a picture," although this was not necessarily a universal portrayal of how they utilized the drug information. What emerged was a sense of an initial emphasis on being right and reducing doubts and uncertainties, a factual orientation, and then moving to an emphasis on adding value by getting explanations and forming personal opinions and position statements. This suggests that the picture changes may not be independent, but rather, may be hierarchical or contingent. Given the limited number of cases on which this suggestion is made, this is an aspect worthy of consideration in future related research.

Frames of Reference and Selecting Information

While the study did not focus on why the initial knowledge prior to the exposures was the way it was, nor why some information was chosen or rejected, the girls provided some reasons for their deliberate and highly selective process. They acknowledged that their own personal encounters and experiences provided a focus, a "trigger," a means of identifying related information and a hook for linking new information. Frames of reference in relation to im-

mediate family, as well as aspects of their own age and life cycle also played a part in the selection process, as shown in their selection of information about pregnancy and driving. This raises a fruitful line of enquiry in terms of how variations in personal experiences, existing knowledge, and current stage of life cycle shape adolescents' utilization of drug information.

It was also evident that utilizing the heroin information was shaped by existing knowledge. The existing knowledge became a basis for information gathering, then for interpreting, sorting, grouping, organizing, and integrating the acquired information so as to bring on the perceived effects of constructing, changing, clarifying, and verifying pictures, and to be able to reflect on them. Each girl's initial knowledge was markedly different, as shown in the baseline measures. Even though they were all exposed to the same information, and in the same order, the revised knowledge structures were also markedly different, yet each revised structure retained the stamp of the original, notwithstanding the many transformations that took place. The girls were not passive, robot-like processors of information, merely absorbing information indiscriminately, and replicating the information. Rather, the girls were active creators of knowledge, manipulating information selectively and creatively to develop their revised pictures. Their links to existing knowledge made logical sense.

Issues of Transferability

The quasi-experimental design raises a number of related issues which may impact on the extent to which these findings can be transferred and applied to other contexts. The girls showed a high level of commitment to being involved in research, and were selected in terms of the language skills required for the task. In the everyday world of information seeking and gathering, people have some control over the choice of activities, the information to be used, the level of commitment to them, and how to do them. In reality, the girls may not be so motivated to seek out new information or discount relevant information that might contradict already established beliefs or knowledge structures. With these limitations in mind, this study makes a strong contribution to the developing knowledge base related to cognitive information utilization and to the broader multidisciplinary area of cognitive information processing. It provides a set of constructs that illustrate the complexity of cognitive information utilization, and a workable methodology for digging deeper. The set of constructs and the methodology provide a springboard for further investigating questions surrounding the transferability of the findings.

A key issue also relates to the conceptualization of the perceived effects. The coding of the content was undertaken by the researcher at three different times to obtain some intra-judge consistency. No inter-judge reliability assessments were made, and the conceptualizations, while based on well-established qualitative procedures, represent the author's portrayal of the concept and terms used by the girls.

In essence, the conceptualizations may be seen as organizing assertions rather than intrinsic processes, and as such, provide the building blocks for further investigation involving a larger sample.

Practice Applications

A number of potential practice applications emerge from this study. The findings provide an approach to the design of specific electronic information-retrieval systems based on an understanding about how adolescents cognitively utilize information. The types of effects identified in this study provide an alternative set of categories of desired outcomes which could be built into information systems as a central design feature. This could allow a person to enter the system, not just in terms of the content or document description, but also from the perspective of the cognitive effects sought, such as: Wanting facts, opinions and viewpoints, details, arguments, explanations, or identifying misconceptions. In other words, the findings of the study suggest a design approach of matching user-defined cognitive effects with portraits of particular resources, as well as potential multiple viewpoints related to cognitive effects.

A potentially useful application is in relation to the role of intermediaries in providing drug information to adolescents. Traditionally the role of the information professional has been conceived in terms of matching people to specific resources. The types of information utilization identified in this study could provide a new way of looking at the form of the dialogue between the information user and the information professional. The approach gives attention to understanding the kinds of cognitive effects desired, for example, explanations about how and why, or a range of viewpoints or perspectives about a particular topic, or confirming a particular aspect. In other words, the interview would take a constructivist stance, seeking to ascertain how adolescents want to move on cognitively from where they are with drugs, and seeking to establish the connections and links already existing between ideas. This could contribute to enhanced mediation and help adolescents form a more focused search. Focusing on desired cognitive pictures may help reduce the uncertainty and its affective symptoms of anxiety and lack of confidence, identified by Kuhlthau as a major problem faced by adolescents in their early stages of information seeking (Kuhlthau, 1993).

The findings also have implications for teachers in designing and carrying out classroom instruction, particularly relating to drug education. By understanding how cognitive change happens in relation to the stream of information that is provided to adolescents, practicing teachers can design better instruction to facilitate pictures. They can create opportunities for information utilization to arise; they can help adolescents more effectively understand their own constructive processes; and help them articulate how they interpret and find meaning in information. This puts emphasis on learning as a constructive process, and adolescents as people who understand their constructive processes.

This study also raises some implications about the dissemination of information about drugs, such as through government drug awareness services, media, and school education campaigns and citizens groups. Often drug awareness campaigns and education programs convey the idea that simply making the information available, and often with graphic portrayal of serious consequences of drug abuse, will convert the existing drug problems of adolescents into non-problems, and that without any special effort on their behalf, positive personal change and social action will prevail. The study shows that no matter how compelling or authoritative information might be in the minds of others, no matter how useful someone else might think the information is, these qualities do not guarantee its receptivity and utilization by adolescents.

More specifically, the study suggests that matching choice of information to where adolescents are in their personal and social experiences and their physiological development may mean that it is utilized more effectively and integrated more meaningfully into their existing knowledge. Targeting the provision of information to specific aspects of the immediate contexts and life stages may be a productive step forward. This suggests shifting the focus from one of providing a mass of facts considered "true," to a more careful, perhaps limited selection of content based on understanding the kinds of cognitive utilizations that students are seeking. This study provides a methodology for understanding these complex interactions in the context of provision of information to adolescents about drugs, and the cognitive effects identified in this study provide a conceptual framework for understanding how, what, and why drug information is needed by them.

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