Imparting Environmental Knowledge Using English as a Second Language: Knowledge Acquisition and Knowledge-Based Behavioral Changes

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Abstract

Environmental courses are now incorporated into curriculum at all levels -- pre-school, elementary, high school, tertiary, and doctoral programs. The need for environmental courses arises from the increasing global awareness on environmental degradation and the urgency of a global warming agenda.

This research aims to better understand knowledge-based behavioral changes, and found that while certain aspects of the topic of "health and environment" can be learnt through reading and lectures, hands-on activities helps students to retain knowledge more effectively. An objective of an environmental course is not only to create an appreciation of natural resources, but also to bring about a change in individual's behavior towards environmental protection. Therefore, it is critical that students receive opportunities to personally experience and enjoy the natural environment, in order to understand the health benefits from natural resources, and extend their appreciation of green environment into eco-friendly behavior.

Hands-on activities that engage the student in collaborative learning, involving two-way communication mediated by the teacher, were found to be most effective in imparting knowledge, especially when the language of instruction is not the student's mother-tongue.

Keywords: environmental education, knowledge acquisition, collaborative learning, knowledge-based behavioral change

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I. Introduction

Environmental courses are now incorporated into curriculum at all levels -- pre-school, elementary, high school, tertiary, and doctoral programs. The need for environmental courses arises from the increasing global awareness on environmental degradation and the urgency of Global Warming agenda. The current global interest in sustainable development is a result of the imminent threat of global warming, e.g. environmental degradation, rising ocean levels that result in the disappearance of entire countries.

The objective of this research is to investigate teaching approaches that can meet this challenge - teaching methods that foster knowledge-based behavioral changes. In particular, this research also addresses the challenge of knowledge-based behavioral changes when the knowledge was imparted in the student's second language, namely English, the language of instruction in an international program at a Thai university.

Given that the respondents in this study were Thai college students enrolled in an international program, where the language of instruction was English, their second language. Therefore, constructs from studies that were related to knowledge acquisition through a second language are also considered, e.g. Chu's (2008) study which examined the interrelationship among shyness, learning strategy use, learning motivation, foreign language anxiety, and willingness to communicate. There are similarities in that student samples in both studies came from the capital city, namely Taipei and Bangkok, which has higher exposure to English language, strangers and foreigners in daily life due to higher population density and bustling international business activities.

This inter-disciplinary research draws upon environmental studies, mass communication (marketing), and educational psychology for learning English as a Second Language (ESL). The junction where these three disciplines intersect are as follows:

- **Student's learning goals** (Learner focus on functionality and usability; The demand from "knowledge customers" to collaborate, not just simply consume)
- **The role of the teacher** (The teacher as a mediator of dynamic two-way communication; Learning strategies initiated by teacher's teaching methods)
- **Knowledge acquisition for practical use** (Willingness to Communicate (WTC); Motivation on knowledge acquisition and knowledge retention; Learning strategies stimulated among the students themselves)

1) The nature of environmental studies

Environmental degradation directly affects all aspects of human health, the quality of agricultural food source, and the earth's ecological system. Therefore, environment-related courses are critical in bringing about behavioral changes in the students. In other disciplines, it may be sufficient for teachers to impart knowledge about environment-related health issues to students in ways that help students remember and pass on the learned information. In the environment and health area, the goal is to bring about behavioral changes in the students, that means they need to bring the knowledge from the classroom into their daily lives.

2) Student's learning goals

Students learn differently because each is likely to come to class with different goals. Students have different levels of motivation, which shows in their in-class behavior, e.g. participating more actively in class.

Students respond to information based on their cultural and cognitive identity. This is supported by a study by McEwen et al. (2005), which found that how a student learn depends on their expectations and priorities, both of which are shaped by their learning experience and cultural experience. Therefore, knowledge needs to be imparted to students through two-way communication methods that engage students at more complex levels than lecturing (one-way communication).

It can be observed that there are two issues that concern the learner, i) learner focus on functionality and usability, and ii) the demand from learners as "knowledge customers" to collaborate, not just simply consume.

i) Learner focus on functionality and usability

Students demand information with functionality and usability, say Stuart, Sarow and Stuart (2007). To students, this means taking an active role in the learning process. They want to share information (evidenced by the spike in social networking in most every country, including 3rd world countries with little or no resources), and create something of their own (user-generated content, book self- publishing, on-line photo albums, creative artwork through computer technology).

Students of preceding generations were satisfied with their role as passive consumers, willing to buy into the one-way communication method of academic lecturing. But students today are more likely to value communal sharing and creating a workable plan of personal learning in which they have some input.

Therefore, on-site visits, hands-on activities, service-learning projects and cultural experiences that brought students into direct contact with environmental or ecological issues enables sharing and collaborating with other students, teachers and community members. These activities also allow each student to determine his or her own "plan" for incorporating what he or she has learned or experienced.

After experiencing, questioning, opinion-gathering, students ultimately choose what they want to retain from the experience. One may feel the need to join a community-based group, another may turn off lights at home to save electricity, still another may decide on a course of more investigation.

In the end, it is up to each student to determine the benefits of the experience. Acquiring information as presented in a one-way classroom lecture is of little interest and of little use to today's student.

ii) The demand from "knowledge customers" to collaborate, not just simply consume

In marketing, consumers are categorized by marketers as having have different personalities, based on demographics and psychographics, e.g. customers have different characteristics and consumption behavior that can be grouped as generation X and generation Y. Likewise, students can be seen as "knowledge customers" who consume knowledge.

As would be expected, today's generation of students have different characteristics from previous generations. In the past, rote learning (memorizing and reproducing) was the basic way of knowledge acquisition. Classes were taught through lecturing, i.e. the mainstream method of knowledge transfer was second-hand knowledge from the textbook or from the instructor, conveyed by words to the learner. However, for today's knowledge customers, reading a textbook is not the way today's students want to learn; it's not the way they are conditioned by their 21century environment to learn. Historian Alan Brinkley commented on textbook learning, saying, "Nobody chooses to read a textbook. They read a text because they are told to" (Kornblith & Lasser, 2005, p. 1395).

Today, according to Shirky (2010), members of the younger generation no longer value their role as simply consumers of knowledge. They want to be active players who have a part in the product (knowledge) they buy" into, i.e. they want to collaborate. Reither and Vipond (1989) provide a constructive way of looking at the collaborative process. They describe it as three-fold: coauthoring, workshopping and knowledge making.

Therefore, developing a collaborative creative process into a model for teaching environmental studies is necessary for today's interactive, multi-platform, content-producing student.

3) The role of the teacher

The challenge in teaching environmental science lies in the ability of the teacher to inspire the students to appreciate nature. When students value natural resources, they are more likely to make personal sacrifices, forego convenience, and support nature in their day-to-day decisions, e.g. recycling, carrying a cloth shopping bag, turning off the lights, having air-conditioner set at 25 degrees Celsius. Success in a world environment course lies in the learner's decision outside the classroom in the long term, to go out and make purchasing decisions that reflect their knowledge, e.g. consuming organic food or buying eco-friendly products that may cost more.

Environmental studies success cannot be measured by knowledge retention in the short term to pass examinations. Students need to link what they learn in the classroom to real world situations outside the classroom. A study by Bixby et al. (2003) described the value of "service learning" projects in environmental sciences, where students can learn about global sustainability by exploring issues such as energy and its effects on their everyday lives.

i) The teacher as a mediator of dynamic two-way communication

Teaching methods with more student involvement tend to lend themselves more readily to two-way communication. In a study of collaborative action research for the Management for Organization and Human Development Project (MOHD), conducted with researchers spanning eight national cultures, Somekh (2006, p. 102) noted that "to be effective and productive, collaborative (action) research starts with a recognition of the need to be honest about problems, spend time listening to one another and respect cultural difference, in terms of assumptions, relationships, methods and working practices."

In support of this challenge in teaching environmental studies, it has been said that "the engaged voice must never be fixed and absolute but always changing, always evolving in dialogue with a world beyond itself" (Hooks, 1994, p.11). In line with Hooks' emphasis, it may be observed that textbooks and lectures are too static. In comparison, field activities create dialogue and are always changing.

A "gateway" to using what students learn from hands-on activities is that they dialogue/share with others and can adapt the learning to themselves, their needs, their intent, their goals, etc. This is supported by the UK educators Meyer and Land (2003) study on "conceptual gateways" -- threshold learning that students must accept, enter and crossover, no matter the discipline. Meyer and Land (2003, p.5-6) conclude that these gateways are transformative, requiring a shift in perception of the learner; irreversible, unlikely to be forgotten or unlearned; integrative, introducing the subject to the inter-connectiveness of knowledge; and troublesome, hard to put out of one's mind.

ii) Learning strategies initiated by teacher's teaching methods

Employing a variety of teaching methods to impart knowledge meant that students had to use different learning strategies to acquire and retain knowledge.

Naturally, when it comes to acquiring knowledge with English as the medium of instruction, this would also automatically involve learning more English as a second language. In learning a language, Rubin (1981) found that observation in language classrooms did not yield useful information about strategies or communication patterns as language instructors did most of the talking. Likewise, students learning World Environment may learn less from lectures, since the teacher would be doing most of the talking in English.

Learning strategies have received much attention both in the field of educational psychology and second language learning, and Chu (2008) cites several examples, metacognitive strategies, cognitive strategies, and Social/affective strategies. It is important to note that there are also several other categorizations of learning strategies (e.g. Bialystok, 1978; Chamot, Barnhardt, El-Dinary, & Robbins, 1999; Cohen, 1998; Naiman et al., 1978; Rubin, 1981; Wenden, 1991).

Metacognitive strategies relate to how the student manages his/her learning. Metacognitive strategies are high order executive skills that may entail planning for, monitoring, or evaluating the success of a learning activity (Brown et al., 1983) and are applicable not exclusively only to language learning tasks (Nisbet & Shucksmith, 1986), but to the acquisition of all bodies of knowledge. In this instance, a student would receive a greater opportunity to manage his/her learning in carrying out an individual project, but would have less control over learning management when it is a group project (team work).

Cognitive strategies relate to how students think about their learning. Cognitive strategies are used to deal with incoming information, manipulating ways that enhance learning; they can be subsumed under three broad groupings: rehearsal, organization, and elaboration processes (Weinstein & Mayer, 1986). Students may employ this strategy when they present their group project to their classmates in front of the classroom, since they have to internalize or process new information and experiences (e.g. research, site visit, interviews, etc.) into knowledge, and then manipulate their own understanding (categorize, codify, compare, etc.) and present it in a form which effectively transferred to their classmate audience. During the Q&A session after making their presentation, the students also have to elaborate knowledge to answer questions from their friends.

Social strategies involve learning by interaction with others, and affective strategies refer to students' feelings and emotions regarding learning (Oxford, 1990). Hence, social/ affective strategies involve either interaction with another person or control over one's affect or preference, and this group of strategies is considered to be applicable a wide

variety of learning tasks (Chu, 2008). For example, female students face peer pressure and tend to be beauty conscious, and thus may be keenly interested about environmental topics related to physical health, such as eco-friendly natural cosmetics made from organic herbs and not tested on animals, fabrics and fashion using pastel vegetables dyes without animal fur. On the other hand, male students would tend to be more interested in environmental conservation related to sports such as green energy drinks, mountain hiking and river rafting, and perhaps also global warming issues related to technology and innovation, such as solar and wind energy, hot-air balloons, hybrid cars and eco cars of exciting designs.

4) Knowledge acquisition for practical use

Due to the variety of teaching methods administered throughout the course World Environment, variables in learning a subject that has real life practical use are also applicable to this study. For example, Chu's (2008) study on English language learning and use also looked at "Willingness to Communicate - WTC" (as opposed to "shyness"); learner motivation, and learning strategies. These three variables are highly likely to exert a strong influence on the impact of communication on knowledge acquisition, retention and practice (actual usage) in this study, particularly when it comes to environmental knowledge imparted through the non-native language of English.

i) Willingness to Communicate (WTC)

From Chu's (2008) study, it suggests that learning, as with language learning, is facilitated through meaningful interactions. Willingness to Communicate (WTC), namely "an individual's predisposition to initiate communication with others" (McCroskey, 1997, p.77) brings about meaningful interactions (McCroskey & Baer, 1985; McCroskey & Richmond, 1987). This is also supported by research on interaction-driven development (Long, 1996; Mackey & Gass, 2006; Swain, 2005).

Thus, knowledge acquisition would likely be more effective for students with higher willingness to communicate (less "shy") in different settings, such as during in-class discussions, during team-work or group projects with their classmates, during their interviews with people they had never met, e.g. invited guest speakers and the strangers whom they interviewed during their study tours and site-visits.

While the is seemingly slight differences in that Chu's (2008) study looked at Taiwanese undergraduate students, whereas this study gathered data from Thai students, which in fact it is a strong socio-cultural similarity between the two studies. Both Thai-Buddhist culture and Taiwanese Taoist-Buddhist societies share similar social norms in that outspokenness (as opposed to shyness or restraint in expressing personal opinions outright) by youths could be interpreted as aggressiveness or disrespect. According to Chu (2008), individuals in Chinese societies are encouraged to restrain personal desires in the interest and wellbeing of the greater good, whereby children who are sensitive, cautious, vigilant, and behaviorally restrained are either called guai, which means "good" or "well-behaved" in Chinese, or dong-shi (understanding), both favorite words used to praise children (Chen et al., 1998). Chu (2008) even suggested that "shy-anxious" Taiwanese students with "internalized self-control" are often given honored and leadership roles at school, and considered socially fit (Chen, Rubin, & Li, 1995; Chen, Rubin, & Sun, 1992; Chen, Wang, & DeSouza, 2006). This Eastern restraint on spontaneity in communicating is a leadership trait that works in contra-distinctive ways from Western leadership traits of being outspoken and assertive.

ii) Motivation on knowledge acquisition and knowledge retention (learning about Environment & Health using English)

Each individual student also has different levels of motivation (both intrinsic and extrinsic) to learn more about environmental issues and personal health benefits from being environmentally conscious.

The Socio-Educational Model put forward by Gardner and Smythe (1981) as used by Chu (2008) to study motivation in learning English. This can also be applied to understanding the motivation of students in this study, in acquiring knowledge about the environment and its health benefits, through English as the language of instruction.

Gardner and Smythe (1981) identified possible motivational characteristics in terms of four categories - Group Specific Attitudes, Course Related Characteristics, Motivational Indices, and Generalized Attitudes. Later, Gardner (1982) also proposed a modification of this model in which he distinguished four components, the Social Milieu, Individual Differences, Second Language Acquisition Contexts, and Outcomes.

In addition, further research by Gardner (1985), Gardner (2001), Gardner & MacIntyre (1993) found that attitudes were shown to affect motivation in learning. In the latest version, the category of External Influences replaces that of the Social Milieu of earlier versions, e.g. history (socio-cultural milieu in which the individual lives, such as polluted Bangkok city; and personal background such as illness from consuming food with preservatives or pesticide residues) and motivators (the role of the teacher, the guest speakers, the projects and assignments, the study tours and site visits) would fall under this category.

Thai students' motivation to explore and learn more about health and environment, be it through English or Thai language, would likely lead them to continue using this acquired knowledge about green behavior, and actual practice in daily life later on, hopefully long after the course had ended. The influence of motivation on the retention and usage of knowledge acquired through the World Environment course (about environmental protection and practical health benefits) would be similar in manner in line with the findings of Gardner and Lysynchuk (1990), who reported that learners' motivation enhanced the retention of second language skills after classroom instruction, for motivated individuals continue to use the language subsequently.

iii) Learning strategies stimulated among the students themselves

Research suggests that students are more likely to learn better if they formed student teams on their own with self-selected buddies, and also learn better when allowed to choose their own environmental topic as a term project (learning task).

Allowing students to form their own teams may foster knowledge acquisition. For example, Chu (2008) explained that during the learning process, students make several choices, which may not be completely academically related, e.g. choosing their best friend as a study buddy, because the learner feels more comfortable studying with that person, not because he or she is good at the subject. This is also supported by Riding and Rayner (1998) who argued that an activity becomes strategic when it is particularly appropriate for the individual learner, in contrast to general learning activities that a student may not find as helpful.

In terms of knowledge acquisition and retention, assigned tasks from the teacher may be less effective compared to letting students create their own projects. A learning strategy is useful when it relates well to the learner's task at hand, and fits the particular student's learning preferences, according to Ehrman, Leaver, & Oxford (2003, p. 315) who argued that "a given learning strategy is neither good nor bad; it is essentially neutral until it is considered in context".

This suggests that an individual's "optimal" way to learn also depends on the learner's preference or motivation. Hence, students are also more likely to choose a project topic based on their interests and preferences, both of which are influenced by their real-life social context, resulting in better use of that knowledge in daily life.

II. Methodology

In order to shed light on the issues outlined above, data was collected from two groups of students taking a course entitled "World Environment". The total of 98 student respondents were taught this course through different modes of knowledge delivery, namely lecture with power-point presentations, guest speakers, discussions among themselves moderated by the instructor, workshops run by the instructor, field-trips organized by the instructor, and self-research on a topic that were chosen by the students themselves for in-class presentations by groups of students to the class (group project).

The teaching methods can be classified based on the degree of the teacher's role, the practical usage, and student's own learning goals/involvement in Table 1 below:

Table 1: Classification of teaching methods according to the factors affecting knowledge acquisition

Teaching Methods	The role of the teacher	Knowledge acquisition for practical use	Student's learning goals
Team project task (students freely allowed to form team with buddies, and organized their own study tour or site-visit outside class time to conduct interviews)	Low	High	High
Study tour or site-visit organized by the teacher (during class time, scheduled for a whole day or half-day) with guest speaker on-site	Medium	High	Medium
Classmates' presentation	Low	Medium	High
Invited guest speaker to share knowledge experience with the students in-class	Medium	Medium	Medium
Documentaries shown in-class by the teacher	Medium	Medium	Low
Lecture by the teacher with power-point presentation (in-class)	High	Low	Low
Individual research from books, on-line data	Low	Medium	High

At the end of the course, students answered the following open-ended questions about what they remember from the course, administered through a paper questionnaire.

1. What was memorable about the things that you learnt in this course (name 3)
2. How did you learn these 3 things? Where did you learn it from? E.g. class presentation, lectures, movies, photos on PowerPoint, study tour, on-site visit, guest speaker, reading on your own, doing group project with friends, discussion in class
3. What are the health benefits that you can get from the environment?

The students were not informed of this open-ended optional question, nor of the actual objective of the questionnaire. Firstly, it was so that this open-ended question could be answered as much in detail, or as little as the respondent wished, which was the best that the researcher could do to be as similar to a face-to-face interview as possible, given the time limitation to collect data for this study. Other alternatives of data collection were also considered. For example, interviewing 98 students face-to-face one student at a time meant that the question would have leaked from the first interviewee to the others, giving them time to prepare, making it impossible to measure what each student respondent really found to be "memorable".

Secondly, as the examination was administered in English, the answer also had to be written in English. This meant that Thai students tended to prepare written English paragraphs at home for their examinations, because they would consult the dictionary and other sources, get together with friends who would then get external help in correcting their grammar. Therefore, had they been given time to prepare in advance specifically for this question, then the resulting data would be limited to a few version of answers being circulated from the 98 students. Finally it was decided that the only way to administer the question to everyone at the same time in the most practical way (given the timing of the study taking place during the final exam week), was to put this as an optional final exam question.

III. Data and Findings

There was 65% response rate. Of the 98 students, 64 students chose to fully complete the open-ended questionnaire, which was an optional question in the final examination of the course "World Environment". While the final examination carried only 15% of the total course grade, the students were enthusiastic and everyone answered this optional question, some wrote to great details, while others were more succinct.

While 65% of usable questionnaire is a high response rate, actually every student answered this question. The reason that some of the questionnaires were not completed fully had to do with how the student answered this optional question. Firstly, the question had asked for the top three most memorable knowledge about the environment that they had learnt from the course, and some students chose to rank two or even three environ- mental knowledge as their very most memorable, instead of ranking them in succession (as most memorable, more memorable and memorable). Thus, those questionnaires were not

usable. This may have been caused by the directions or the wording of the optional exam question, and a student might have interpreted that a 'most memorable' knowledge would carry the highest points during grading by the teacher (respondent bias).

Likewise, misinterpretation by some students in a similar manner resulted in question-naires that listed out every environmental topic covered in the class. Apparently these latter group of students thought that this open ended question would earn higher grade the more information was written. Again, these questionnaires were flawed.

Another group of questionnaires that could not be used were those where the respondent described environmental knowledge that they knew, but were not covered by the course. The demonstration of external knowledge could not be linked with the teaching methods used in the course, and thus cannot be used to measure the effectiveness of knowledge acquisition through differing teaching methods, which is the focus of this study.

The students also had to describe the learning method through which that environmental knowledge was acquired, e.g. lecture by the teacher, the guest speaker, from classmates' presentation, conducting interviews by the student himself/herself, from the study tour or site-visit, learning while carrying out the team project task, individual research, etc. This is summarized below in Table 2.

Table 2: Student's Knowledge Acquisition from Various Teaching Methods

Teaching Methods	Most Memorable	Most Memorable	Memorable
Team project task (students freely allowed to form team with buddies, and organized their own study tour or site-visit outside class time to conduct interviews)	40	30	25
Study tour or site-visit organized by the teacher (during class time, scheduled for a whole day or half-day) with guest speaker on-site	17	11	9
Classmates' presentation	2	9	10
Invited guest speaker to share knowledge experience with the students in-class	0	0	3
Documentaries shown in-class by the teacher	0	2	5
Lecture by the teacher with power-point presentation (in-class)	2	3	4
Individual research from books, on-line data	1	2	0

Based on the above data collected, the findings suggest that students learn the best (1st ranking, highest rating) when they do teamwork with their very best buddies, themselves choosing the topic for the group project that interests them. The researcher suspects too, that the students spoke Thai during their self-organized study tours outside class time, so they were able to communicate more extensively.

They learn better during study tours organized by the teacher (2nd ranking), suggesting that although the teacher feels that topic is important, students still learn better when they themselves get to choose the sites for the study tours. This is despite the fact that students still get to hang out with their entire class of classmates during teacher-organized study tours, where the University rented two tour buses for each trip. It was possible that because they felt supervised by the teacher and the 3 administrative staff assigned by the university, they were less communicative. Or, it might be that the students were so interested by their new surroundings that they were slightly distracted.

The students learn well (3rd best) from classmate's presentations. This may be influenced by the fact that group project presentations were on topics that their peers had chosen themselves, suggesting a strong common interest in self-chosen topics among the age group.

It was thought that guest speakers would be starkly better than lectures, but it turned out that students learned better from the teacher, with whom they are familiar with, than from invited stranger guest-speaker. Maybe this is due to the English accent of the guest speakers, who were foreigners, and not always native speakers. E.g. Portuguese, French, Americans were invited as guest speakers in this course. Only 3 rated the guest speakers as merely memorable.

Although one would have thought that the students would enjoy movies and documentaries shown in class, no one rated movies as most memorable. Maybe this was due to the language barrier, as the documentaries were in English, and also did not provide the opportunity for spontaneous two-way communication, unlike during the study-tours and site visits, be it organized themselves, or by the teacher.

Students also learnt from their classmates' presentations. They were familiar with their fellow classmates, and understood each other's broken English better than native-speakers' English.

Finally, individual research also did not lead to much learning. This highlights the role of the teacher and buddies in knowledge acquisition.

Teaching methods that involved the student most were found to be most effective in imparting knowledge, leading to the highest knowledge acquisition (most memorable), especially in the situation where the language of instruction is English, not the students' mother-tongue.

IV. Conclusion and Limitations

An analysis of the data collected through the open-ended paper questionnaire suggested that the most effective teaching method in imparting knowledge, especially in the situation where the language of instruction is not the students' mother-tongue, were teaching methods that allowed for the highest level of communication (among buddies) and the highest freedom in topic selection. Teaching methods involving knowledge acquisition through first-hand experience from study tours and site visits, be it arranged by themselves (very best) or by the teacher (second best), also fostered learning greatly. When it comes to second-hand knowledge acquisition, they learn best from peers of their own age, i.e. through

classmate's presentations, which is the third best teaching method. Lecture by the teacher turns out to be a far less effective teaching method.

However, further research needs to be conducted, in order to fine-tune the findings, e.g. pointing out problems inherent in this hands-on approach to imparting knowledge, and possibly to suggest practical and realistic solutions to such problems.

While this study could ascertain the teaching/learning methods that the students were most inspired by, remembered, or liked the best; it cannot predict that the learner will practice a behavior related to what information they were presented or how the method which inspired them to learn. Appreciation does not necessarily lead to action, i.e. behavioral change.

This study captured knowledge that was retained at the end of the course, how teaching methods were valued by the learner. A follow-up study 6 months to a year after completion of the course of study would help determine if knowledge retention was effective and if positive behavioral change occurred in the long term.

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