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Learning Approach and Learning: Exploring a New Technological Learning System

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Introduction

Examination of the impact of the learning approach on learning is a complicated challenge since it is influenced by personal attributes and diverse social and cultural factors. The uniqueness of this study lies in the attempt to cope with part of this complexity through a research population that, for many years, was exposed to a specific learning approach. Its general aim is to deal with the basic question of whether a particular learning approach in one subject influences the individual's way of learning another subject..

This study was conducted on students from the ultraorthodox religious sector in Israel, whose learning approaches are distinct. They study in Yeshivot (higher institutions of Torah study) characterized by distinct approaches that are consistently preserved for years.

Ultraorthodox society has reservations about the use of technology, seeing it as a threat to its values and beliefs. This conservatism makes it an interesting test case of the dynamic relationships between technology, society and culture (Horowitz, 2000). In recent years several changes occurred in that sector that led to an element of openness to modernity. In an attempt to encourage the integration of

the ultraorthodox population in the labor market, academic institutions offer them suitable programs of study. Our study embraced such a group of students enrolled as the research population in such a program.

The ultraorthodox students, therefore, who spend many years in Yeshiva following a particular approach, afford a unique opportunity to examine the more general abstract understanding of the way a learning approach may be related to learning and performance under different unique circumstances.

The study is based on the conceptual framework according to which the learning approach is one of the factors shaping thought, learning style and learning performance. The underlying reason for the study is a consequence of that assumption, which was to examine whether there is a one learning approach that has a greater influence on handling a new technological learning system. This question is of key importance in the educational world in which technology holds an increasingly strategic position.

Theoretical Background

Learning approaches

The learning approach is anchored in the philosophical concept and the didactic method of teaching and learning strategies. This manifests the learning objectives and their orientation that include furthering knowledge, repetition and reconstruction, application, understanding, observation from a different perspective and shaping thought (Dart, Burnett, Purdie, Boulton-Lewis, & et al., 2000). The learning orientation refers to motivation – learning aimed towards achieving results or learning for its own sake. The starting point of product-directed learning is that the ability leads to success while emphasizing competitiveness and outside assessment encouraging the student to prove his ability. The starting point of learning is that the effort itself can lead to success while preferring challenging assignments and self-assessment, with the emphasis on improving the learner's ability (Watkins, 2010).

Learning strategies that, together with the philosophical concept, define the learning approach are the elements used by teachers to help students understand the information in depth. The responsibility in this case is the teachers' with the emphasis on planning, processing and methods of implementing the learning.

Learning strategies are also linked to, and influenced by, the learning style. The concept of learning style has diverse definitions that reflect the complexities pertaining to the investigation of the learning process (Swanson, 1995). All the definitions are directed, in essence, to the basic question of how a person learns. Keefe (1979), whose definition became widely accepted by many researchers, defines learning style as the totality of the cognitive factors, both effective and physiological, that affect the way a person filters and processes information, and affords it meaning. Kolb (1984), refers to learning styles at two dimensions: methods of absorbing information that are divided according to concrete or abstract perceptions, and methods of internalizing the information that are either active or reflective. Key to empowering learning is identifying learning style preferences, and adapting the teaching and learning strategies to these preferences (Kagan & Kagan, 1998; Lazear, 1991; Riding, 2002).

Diverse learning and teaching strategies exist, such as project-based learning, contextual learning, case studies, role playing or problem-based learning (PBL). Learning around a problem, mainly shared PBL that includes interaction, emphasizes developing cognitive skills as part of its objectives (Johnston, James, & Lye, 2000; Zohar. & Dori 2003) and is significant in applying the knowledge regardless of the learner's cultural background or social location (Zoller, 2001).

The Sephardic in-depth study method and the Lithuanian casuistry approach

Studying Torah in Yeshivot relies, to a considerable extent, on shared PBL. Two prominent methods of PBL developed in the Yeshiva world, and were examined in this study: the Sephardic in-depth study method (SDS) and Lithuanian casuistry (LC).

The SDS method was developed in Spain in the second half of the 14th century. It applied Aristotelian logic and established the interpretation of the Torah as a meticulous, logical, cognitive system, similar to the exact sciences. The objective is to attain independent and exact understanding of the interpretive text and to strive to appreciate the original intention (Ravitski, 1983). According to the Aristotelian approach language is a means to express thought and comprehension, and, accordingly, attention must be paid to the differences between the various wordings, while quotations from the sources must be exact. The SDS method is very didactic, linear and structured according to a gradual and methodical order. This learning approach is product-directed with the basic principles being (a) maximum study of the given problem without its comparison to parallel topics, in order to understand each detail of the language; (b) the use of concepts from the theory of logic; (c) developing the learner's independent interpretive ability, and his ability to draw conclusions that might be the correct interpretation of the issue (Boyarin, 1989).

The LC method was developed in the Middle Ages and is characterized by thought that does not focus on the essence of things but on abstract logical ability. The purpose of studying is to clarify the philosophical essence of concepts and relationships to each other, rather than their direct significance. The method is characterized by disregard for simple facts, and focusing on the distribution of all the alternatives that are logically feasible. The LC approach includes comparisons between different texts, their classification, solving contradictions between them, and finding fine differentiations between one subject and the next, even if it is necessary to invent grand fabrications without a textual basis (Ravona, 2003). This method of study led to involvement in acuity for its own sake, and the intellectual game of casuistic study became a value unto itself.

Learning according to the LC approach is not structured and systematic, as is the SDS approach. Learning is based on quick reading of a given issue, locating the central theme, group discussion and links to similar actual cases, as well as the search for similar issues. The LC method, which is more common than the SDS method, enjoys much criticism, due, mainly, to the demand for abstract, multi-directional and global thought that prefers involvement with the larger conceptual picture and is not suitable for many of the students who live in an atmosphere that stresses the tangible and the substantial (Ravona, 2003).

Table 1 compares general attributes of the two learning approaches – the SDS and the LC approach - as regards structure and learning orientation, for example, that hone the differences between them.

Table 1. Comparison of the learning approaches

Attribute	SDS approach	LC approach
Structure	Linear, structured and gradual	Multi-directional, scattered
Study orientation	Realizing operative conclusions through in-depth reasoning	Learning for learning's sake and realizing philosophical conclusions that are not essentially operative
Scope of learning content	Large quantity of material studied according to a defined order and timetable	Number of subjects studied is unimportant, nor their order usually
Sources of study	Texts directly connected to the subject	Texts from diverse sources and not necessarily connected to the subject
Group study	In pairs	In groups of 4-6 students

The learning approach and shaping thought

Constructivist theory avers that the learning method leads the construction of personal knowledge and cognitive skills (Cobb, 1994; Driver, Asoko, Leach, & Scott, 1994). For decades, the promotion of students' cognition has been the focus of educational studies and programs (Boddy, Watson, & Aubusson, 2003; de Bono, 1976; Ennis, 1996; Watts, Jofili, & Bezerra, 1997).

De Bono (1976) developed several approaches to teaching cognitive skills and showed long ago that students who were exposed to certain teaching strategies submitted many more solutions to problems compared to those who did not follow those strategies.

Studies on the connections between learning and cognition employ cognitive concepts of a higher and lower order to describe cognitive skills. Higher order thinking can be conceptualized as a non-algorithmic, complex mode of thinking that often generates multiple solutions. Framed in more traditional terms, higher order thinking corresponds with the taxonomy of Bloom, Englehart, Furst, Hill, and Krathwohl (1956), of overlapping levels above comprehension. Accordingly, recall of information would be an example of lower order thinking skills, whereas analysis, evaluation, and synthesis would be considered higher order thinking skills. Indeed, learning strategies focusing on analysis, evaluation, and synthesis, develop skills in problem solving, inferring, estimating, predicting, generalizing and creative thinking (Wilks, 1995), which are all considered higher order cognitive skills. (Barak, Ben-Chaim, & Zoller, 2007; Zohar & Dori, 2003; Zoller, 2001).

Another concept frequently used in the research literature is multi-directional learning and thought. The multi-directional learning approach is based on cognitive flexible theory, according to which learning from various perspectives leads to flexibility in a person's knowledge base (Spiro, Feltovich, Jacobson, & Coulson, 1992). In multi-directional thought, according to Guilord (1975), a person employs

his knowledge to find many and diverse solutions to a problem relative to uni-directional focused thought wherein people seek the one correct answer.

In this study the two learning methods examined demand cognitive abilities of a high order. However, the LC approach is characterized by multi-directional dispersed thought relative to the SDS structured and deep linear approach. We asked whether these differences in cognition in learning methods would be manifested when the research population would be faced with a new learning system that is not from their area of knowledge.

Learning method and learning performance

Studies indicate that learners' motivation and performance are influenced directly by the learning approach. A learning approach that encourages learning for its own sake, such that it does not emphasize achievements and products, and encourages multi-directional thought, led to better learning results (Watkins, 2010). These learning performances were manifested in the use of more learning strategies and greater perseverance, in presenting metacognitive knowledge of their learning and higher motivation (Schraw, Horn, Thorndikechrist, & Bruning, 1995). Moreover, this learning approach even helped raise academic achievements that were statistically significantly higher relative to learners who studied according to the focused, very structured approach to attaining results, and encouraging competition and achievement (Wolters & Rosenthal, 2000). Hence the learning approach that focuses on the learning process raises learning performance, while that which focuses on results and on outcomes in fact harms the learning performance.

The SDS approach in this study is one that strives to achieve a clear product in a structured and fundamental way directed at realizing the product. In this case the product is a conclusion according to Jewish law that solves a disagreement or religious or social issue, and clearly determines how one should function in the matter under discussion. The LC approach, on the other hand, does not view the product – the decision according to Jewish law – as the learning goal. According to this approach the discussion about the issue is the goal. This, while seeking similar cases and links to current actualities and examination of the broad social and the psychological implications. We asked whether the different focus of the learning approaches would influence the subjects' learning performance when they will handle learning a new subject.

Learning approach and learning with technology

The connections between learning approaches, learning style and the integration of technology in education have been studied since the late 1990s. Liao (1999) and Najjar (1996), for example, note the varying effectiveness of combining multimedia and hypermedia in the context of learning approaches. They, and others (Riding, 2002), attempt to propose adaptations between learning style and its approach and specific attributes of the electronic media.

Other studies that note the connections between learning approach and learning in a technological environment stress the importance of the former on learning tasks (Bolliger & Supanakorn, 2011; Cools, Evans, & Redmond, 2009; Fatt & Joo, 2001). This influence is more prominent amongst adults. Adult learning, in contrast to learning amongst children, is based on life experience and is characterized by a personal learning style and strategies (Korres & García-Barriocanal, 2008).

According to Yu (2010), understanding the factors that influence learning and behavior in terms of learning performance is essential to predict the use of

electronic learning systems. The learner's behavioral expression towards a new learning system, when it is overt, is likely to manifest the learning style and the impact of the learning approach. In learning that is characterized by acquiring skills, the index, when measurable, is the performance - for example, according to quality or speed (Swanson, 1995). As mentioned, a key question that guided us in this study is whether the learners' distinct learning approach affects their performance in the new technological learning system. Clearly, the brief experimentation with the technological learning system does not fully reflect the learners' possible performance. However, this very preliminary learning is likely to better manifest the possible influence of the learning approach. In new and preliminary learning the learners will apply the learning strategies with which they are familiar and which they have adopted.

The Research Questions

This study aimed to explore the possible connections between the learning approach (SDS and LC) and learning performance with a new technological learning system.

We prefaced matters and asked the following questions to examine these connections:

1. Can the subjects' learning approach (SDS or LC) be identified and distinguished by tracking the analysis of the new issue from their worlds of knowledge?

2. What characterizes the learning of each group with a new technological learning system? Can differences be found in the students' learning performance in the different approaches?

Methodology

The research population

The research population included 44 ultraorthodox students who are studying for a Bachelors degree at an academic college of education. All the students have a broad Torah education of at least ten years of study at a higher Yeshiva (which students can attend after 12 years of high school). The attributes of the research population are summarized in table 2, and indicate that these students study there for many years, most following the LC method; most have had little exposure to computers. It is important to stress that the learning method adopted in a Yeshiva is uniform and fixed, and when a person chooses where to study he follows that approach throughout the time spent there.

Table 2. Attributes of the research population (n=44)

Average age	Average no. of years of study in Yeshiva	Study approach in Yeshiva	Do you have a computer at home or at work?	Frequency of use of the computer	Did you learn to use a computer previously?
31.8	11	LC: 23 SDS: 18 Other: 3	Home: Yes:12:% No:88% Work: Yes:18% No: 82%	Moderate frequency: 12% Rarely: 35% Not used at all: 53%	Yes: 6% No: 94%

The research approach

The study is anchored in qualitative-interpretive methodology, the choice of which is suitable for examining the research questions as this paradigm offers an in-depth comprehensive description of the phenomenon, preparing it with all its complexity in the context in which it occurs (Stake, 2005).

Most of the research is based on twenty collective case studies, ten for each learning approach. A collective case study is a collection of specific cases from which one can learn through comparison that emphasizes the generic aspect of cases or their amalgamation, emphasizing the similarities between them (Stake, 1995) . This study deals with collective case studies from two points of view: examination of each subject as a unique, specific phenomenon and reference to the group in general according to the learning approach.

The data were gathered using textual analysis, observations and guided semi-structured interviews.

The research tools

a. Textual analysis of a Talmudic issue: The participants were asked to evaluate and note the method of analyzing an issue from the Babylonian Talmud (the basic book of Jewish law) that deals with the implications of an individual's behavior on the public. A specific issue was selected, with which it is not customary to deal in the Yeshiva framework, and was thus new for the participants. This tool was intended to verify the ascription of each participant to one of two learning methods - the LC method or the SDS method.
b. A guided and focused interview and observation of the experience with the Nova 5000 device, a tool designed by the researchers specifically for this study. Guided focused interviews enable development and expansion of subjects that arise during the interview (Bogdan & Biklen, 1993). Non-participatory observations were combined, intended to enable methodical notation of the behavior of each subject during experimentation with the technological device. Details such as to how the subject tries to deal with each question, does he note down points for himself, does he request help, how does he investigate the device and so on were recorded. The data were noted on information sheets prepared in advance according to the diverse stages of the experimentation that provided a systematic framework for gathering the data.

Experimentation with Nova 5000 and the integrated interview included nine stages, during which the participants were posed open questions. Dividing the interview into stages wherein a different question was posed in each stage facilitated more convenient and exact tracking of the subjects' behavior. Each stage examined a specific aspect, with gradual progression. The experimentation and the interview lasted between 90 minutes and two hours for each participant.

b.1 Description of the Nova 5000 device
Nova 5000 is an innovative system for studying sciences developed by the Fourier company (http:// fouriersystems.com). This is an ultra-portable laptop computer with a 7" touch screen. Various sensors can be attached simultaneously for integrated measurements. In addition, Nova has Multi Lab software for processing data received from the sensors. Apart from the software for conducting experiments, Nova has additional software for learning mathematics, a word processor, presentation software, and so on.,. We chose the Nova 5000 for this study for its diverse learning possibilities. We believed that this diversity would further our ability to assess the learning potential and participants' quality of coping.

Figure 1: Nova 5000

b.2 Stages of experimentation and the interview
The experimentation and the interview were conducted sequentially as one field. The pace of experimentation was determined mainly by the students.

Stage 1: The interviewee was first told that he would be presented with a new learning tool. He would try to familiarize himself with it alone, and while doing so would be asked questions associated with his experience with the device. The absence of correct or incorrect methods or answers was emphasized. The researcher placed the Nova 5000 device in front of the student and asked for what he thought it was used, observed his reactions and noted his answers.

Stage 2: The researcher asked the students to operate the device and discover its means of navigation.

Stage 3: The student was asked to discover the possibilities embedded in the device and was allowed to study it in any way he thought suitable. We noted

the number of minutes needed to discover possibilities, the possibilities proposed, and the answers to the question of how he discovered the various possibilities.

Stage 4: The researcher placed a temperature sensor in front of the student (without giving it a name or explanation) and asked what he thought was its use. The researcher noted the possibilities proposed by the student and his reaction time.

Stage 5: The student was asked to try to connect the sensor. The researcher tracked his attempts to do so, and measured the time needed to make the connection. The options proposed by the student and his reaction time were duly noted.

Stage 6: The student was informed that the accompanying item was a temperature sensor and he was asked to try to take measurements using it. The method applied was noted, as was the time needed for representing the measurement on the screen.

Stage 7: The researcher asked the student to suggest learning activities for students using the device and the sensor. Through the activity the planning, the content of the activity and the reaction time were documented by the researcher. In addition, the student was asked to explain the purpose of the activity proposed, for which target population it was suitable, and which cognitive skills were needed for the activity.

Stage 8: The researcher observed to the student that Nova 5000 offers diverse learning possibilities apart from measuring temperature, and asked whether he could propose additional activities. The activities he proposed and the reaction time were noted.

Stage 9: This stage included five reflective questions: What did you feel during the experiment? Did coping with the device challenge or interest you? What skills do you think are needed to operate the device? What did you learn from performing the task and the way you handled the device regarding your way of learning? Do you think your method of Yeshiva learning helped you to handle the device?

c. A questionnaire on personal background included questions such as age, number of years of study at a higher Yeshiva, the learning method there and the extent of exposure to computers. The findings are summarized in table 2.

The research procedure

The research included the following stages:

1. We asked the 44 students, who agreed to participate in the study, to submit a detailed description of their way of handling a Talmudic topic presented to them. They did this in their free time and submitted the analysis within two weeks.
2. We compared the findings of this classification to the participants' statements regarding their learning approach that appears in the personal background questionnaire.
3. We chose ten students at random from each learning approach for an interview and experimentation with Nova 5000, during which data were gathered

regarding the method of handling the object, and the students' answers to the questions posed were noted.

Data analysis

a. The method adopted by each participant for analyzing the Talmudic topic was classified into one of three categories: the SDS method, the LC method, or another method. The classification was based on a comparison with typical methods of analysis described in the literature (Boyarin, 1989; Ravona, 2003). The solution, typical for each of the methods, entails five stages which, according to the SDS method, are:
   1. Preliminary reading, marking the biblical sources appearing in the question.
   2. Study of the biblical source as it appears in the Bible, and study of the interpretations afforded the source.
   3. Consolidating the main idea of the segment.
   4. Finding the connections between the various issues appearing in the question.
   5. Drawing conclusions pertaining to Jewish law on the subject under discussion.

   The stages in the LC method are:
   1. Superficial reading
   2. Search for the main idea represented in the question
   3. Group discussion of actual similar cases
   4. Examination of the implications of the individual's behavior on further matters and their development in the given surroundings
   5. A search for issues in the Talmud that are similar or that are reminiscent of one of the pertinent aspects

b. Analysis of the interview data and observation of the experimentation with Nova 5000 was based on Marshall and Roseman's (2011) stages of analysis and was conducted in four stages. We first focused on each interviewee and coded the findings of each of the nine stages of the interview and the experimentation. We then analyzed the findings at the group level, calculating the averages for the quantitative data gathered, adding statements of similar general content and focusing the findings. At the third stage we validated the analysis conducted by each researcher independently. At the fourth stage we synthesized the analyses and constructed shared interpretation for the possible significances of the findings. It is important to stress that part of the analysis included a quantitative analysis of the response time regarding certain stages of the experiment. In learning that is characterized by acquiring skills, the index, when measurable, is the performance, for example, according to quality or speed (Swanson, 1995).

Findings and Discussion

Classifying the learning approach according to the analysis of a topic

The method of analyzing a topic enabled us to verify the participants' statements regarding their learning approach, and to examine to what extent they would insist on methods customary according to their style of learning when analyzing a new topic. The results present a clear picture with surprising compatibility. 42 of the 44 participants analyzed the issue according to one of the two learning approaches explored, thus almost all the analyses could be classified accordingly. Comparison of the learning approach declared by each participant in the background questions and

the learning approach identified in his analysis showed remarkable compatibility. Only one of the 42 analyses classified according to the learning approach was incompatible with the subject's learning approach. In all, the textual analysis and the comparison with the subject's declaration found that 18 students belonged to the SDS group and 23 to the LC group.

These findings indicate that extended learning using a consistent approach directly affects the way of learning new problems from the same areas of knowledge.

In addition, the findings confirm the division of the research population into two groups according to the learning approach. Since only three members of the research population had adopted a different learning approach, it was not possible to form another learning approach group and to compare it with the two approaches explored in this study.

Exploring Nova 5000

Analysis of the findings from the observations and the interviews led to identifying three main dimensions that indicate the method of exploring Nova 5000: the investigative dimension that is manifested in the attitude towards the device and its mode of investigation, the technical dimension that is connected to the ability to operate the device, and the pedagogic dimension that pertains to understanding the learning potential of Nova 5000. Another, fourth dimension relates to reflective aspects of the students' feelings and way of learning with the object.

The investigative dimension

The primary exposure to Nova 5000 aroused interest and curiosity amongst most of the students. The understanding that this was a learning tool diminished concerns pertaining to the ideological prohibition against using computer technologies. Most of them guessed, at the first stage of their experimentation, that it was a laptop computer but also suggested additional possibilities such as a tool for measuring blood pressure, a computer game and a camera. The average number of possibilities suggested by the LC group was higher: 2.50 compared to 1.75 on average for a student in the SDS group. In fact, we found a consistent difference between the groups in several interviews or possibilities that were raised. At the third stage, in which the students were asked to reveal what could be done with the device, the number of possibilities proposed by the LC group was, on average double (6.00 versus 3.00). At the fourth stage too, when the sensor was presented, the LC students suggested many more possible uses for the sensor (2.25 versus 1.75 on average).

Additional differences were found in the ways of investigation. Eight of the students from the LC group rapidly moved between the screens, skimming the text, and entered many more screens. Only one student from the SDS group functioned in similar manner. All the others adopted a more systematic approach and read most of the information that appeared on the screen before moving on to the next one. The answers to the question "How did you discover the possibilities embedded in the device?" indicate the differences in the method of investigation. A student from the LC group commented: "*I pressed the various possibilities that appeared on the screen and from every screen I continued to the next one. When this was too complicated I returned to the opening screen and exited it to the next possibility".* A student from the SDS method stated: *"I looked at the marks on the screen and tried to understand their meaning. I had previously seen a GPS and wondered if they were similar. I tried to read what was written on every screen to understand the next step."* Clearly trial and error were more characteristic of a student from the

LC group relative to his colleague in the SDS group who adopted the logical approach based on understanding from observation and connecting to existing knowledge.

We found consistently, throughout the observations, that the average time needed to perform the task in the SDS group was shorter than for the LC group. When, for example, the students were asked to find the possibilities embedded in the device the response time of the SDS group was 4.00 minutes on average, compared to 4.75 minutes on average for the LC group. The students in the latter group investigated the device for longer and discovered many more possibilities. The findings for the sixth stage can be presented as another example, wherein the students were asked to conduct a measurement using the temperature sensor and to present it on the screen: 5.75 versus 3.75 minutes. Entering more windows that characterized most of the LC group took longer relative to the time that most students invested in the LC group.

The technical dimension
This dimension refers to the ability to operate the device. Did the students manage to navigate and discover diverse applications? Did they manage to measure with the sensor and represent it on the screen? The findings show that all the students managed to operate the device, to navigate and to take measurements using the sensor. Differences were not found between the groups regarding the number of requests for help or the type of questions pertaining to operation. These findings indicate that there is no connection between the style of learning and handling the device at the technical dimension.

The pedagogic dimension
This dimension pertains mainly to the stage at which the students were asked to propose one learning activity for the pupils using NOVA 5000 and the sensor. This followed their own measurements with the temperature sensor. The findings indicate differences for diverse aspects of this dimension. It is important to emphasize that all students were exposed to didactic material only in the framework of their current studies.

We found that most of the SDS group proposed activities intended for elementary school pupils, while the LC group also proposed activities for junior high school and high school pupils, divided in similar manner. The activities of the SDS group were mostly focused and more limited compared to those of the LC group that set greater challenges. For example, two students from the SDS method commented: *"The objective is to demonstrate measuring temperature using the sensor…", "The goal is to measure temperature and thus to familiarize oneself with the device"*. Two students from the LC method noted: *"The goal is to understand physical states and that different materials have different temperatures in the same environment",* "*The goal is to experiment with new things, to arouse curiosity and excitement in nature study lessons*".

Differences were also manifested in the activities and the *modus operandi*. Most of the activities in the SDS group were more structured, with focused content and direct modes of action compared to those proposed by the LC group. For example, a student from the SDS method noted, "*The activity will be given in the framework of a nature studies class, starting with an explanation about temperature and methods of measurement. Thereafter the device and the sensor will be presented, a demonstration will be given…and the pupils will also measure the temperature of various objects in the classroom."* A student from the LC group said, *"The pupils*

will measure the temperature of various objects in diverse states and conduct a graphic comparison with the device…they will go out into the school yard and will also measure and compare the temperature of diverse objects outside the classroom .." Only in the LC group were several activities proposed pertaining to measuring temperature over time, at set times. Moreover, many more activities by the casuistic group integrated activities outside the classroom.

The cognitive skills needed to perform activities, believe the students, did not reflect clear differences. Many of the students used similar concepts such as understanding, analysis, investigation, drawing conclusions, and synthesis. Apparently they sometimes use formal terms such as "integration" or "data processing" and interpreted them according to their personal understanding. Congruence between the formal significance customary in the professional literature and the context they afford to these terms was not always found. One may assume that this stems from their limited pedagogic experience.

In general, it would seem that, on the one hand, the proposals for scholastic activity by the SDS group were more structured and practicable, while, on the other hand, the activities of the LC group were more complex and challenging. The activities in the LC group seemed to manifest better understanding of the broad potential embodied in Nova 5000.

Reflection

Questions pertaining to the last stage encouraged the students to speak about their emotions during the experimentation. Some said they had fears at the start but were then drawn to experiment. Others reported an enjoyable experience and curiosity from the outset. There were no prominent differences between the groups regarding the distribution of the feelings reported. Apart from two students (one from each group) who emphasized the feeling of tension and uncertainty, the students summarized their feelings as extremely positive.

Many claimed that in order to successfully operate the Nova 5000 basic knowledge in operating a computer and of sciences is necessary. The response to the question, "What did you learn from performing the task and your way of handling the device about your method of learning?" found that many linked handling the Nova 5000 and the method of Yeshiva learning in their answers. Example of the answer of one student from the SDS group: *"I think that my past and my experience with Yeshiva studies dictate my behavior for I tried to use the device as I would a Talmudic topic…but the study of Torah and the Talmud is in-depth study and abstract, while the device embodies the concept of 'think before you act'*.

The answers to the question, "Do you think the Yeshiva method of learning helped you handle the device?" were interesting. All the students in the LC group were convinced that their learning helped them to handle the device. To our surprise, all the students in the SDS group, except for one, believed that their method of learning was less suitable for handling Nova 5000 and noted that the LC method was more suitable: *"Using the diversified casuistic method a person will cope more successfully with the new technological system as their method (of casuistry) exposes them to many different topics even if not in depth…".* The student from the SDS group, who did not think thus, claimed that the curiosity and the desire to investigate are the main factors for successfully handling the device.

To sum, the reflection stage exposed positive attitudes towards Nova 5000 amongst most of the participants and their perception according to which LC contributes

more to their successful handling of the technological device. This finding indicates that the LC method affords greater confidence for initial coping with a challenge such as that of the Nova 5000.

Summary and Implications

The closed ultraorthodox society that preserves distinct learning approaches for many years afforded us a special opportunity to examine in a more focused manner whether the learning approach influenced contending with a new learning device.

We assumed that the LC learning approach, that emphasizes broad abstract thought, would be more suitable for coping with the philosophical challenges than it would for exploring devices such as Nova 5000. However, we found that those learning according to LC approach discovered more possibilities using the device and offered more challenging proposals as to how to integrate it in teaching.

The LC approach that encourages multiple perspectives and inter-domain thought apparently advanced better understanding of the potential embedded in Nova 5000. Associative learning, in which it is possible to progress in all directions in the learning material organized as hypertext or as hyper media, as technology affords, may be more suitable to whoever is accustomed to multi-directional thought. We have no doubt that systematic and gradual learning, such as the SDS approach, is of great importance in exploring a new learning system. Many of the accepted academic learning methods rely on continuous, in-depth linear learning similar in essence to SDS. At the same time, our findings indicate that more open and less linear learning, that nurtures multi-directional thought such as that in the LC method, may be encouraged.

Several researchers note the advantages of multi-directional thought. Torrance, Goff and Okabayashi (1992), find that the methods developed by the Japanese for solving a diversity of problems, methods characterized by flexibility, broad thought and communications, are preferable to American analytical methods and afford the new basis for the information era. Parnes (1992) also concludes that a creative position is better for problem-solving than intellectual understanding that is involved in taking certain steps using particular techniques or models. In addition, Liu, Lin and Tsai (2011), show that the open and inter-domain approach, that encourages multi-directional thought, leads, in all probability, to identifying the complexity and taking decisions that are based on diverse reasons.

The most significant implications of this study are deepening the teachers' understanding of the influence of their teaching approach on learning, and on shaping the students' thought processes. It is important to strengthen the teaching approach in training student teachers through group teaching that encourages multi-directional and broad thought.

However, multi-directional learning demands far more time, as we also found in this study. Learners using LC consistently need more time to perform the tasks. Many teachers note the element of time as one of the disadvantages of open multi-directional teaching, especially in teaching of this type that integrated technology (Ertmer, 2005). In the achievement-oriented system where one must cover the entire syllabus, this drawback is not to be scorned. However, the significant contribution that such teaching is likely to enjoy must be taken into consideration. As we have found, such teaching affords advantages also to coping with the very

different challenge from the subjects studied by the students. It is reasonable to assume that the very belief of those involved with the importance of multi-directional and broad teaching in education will reduce the common approach that such teaching is a waste of time.

With the increased awareness of the great variance between people regarding their learning processes, it is important to try to learn according to different approaches, including those that seem less suitable to the personal learning style. Flexibility in learning methods, while exposed to multi-directional methods and branching thought, may contribute to handling learning challenges also beyond the substantive context of learning methods, as has been demonstrated in this study.

This study, conducted on a conservative, unique cultural group, arouses thought about the learning approaches applied in a western 21st century culture, a century characterized by unprecedented access to information that particularly challenges questions about learning approaches.

It is important to emphasize that the participants' brief exposure to the technological device does not enable determining the level of understanding and the performance abilities that are likely to change after extended exposure. However, initial handling of a new system that entails difficulties is, in fact, an opportunity for reflecting on the learning, as Salvatori (2000) terms it "pedagogy of difficulty". Furthermore, tracking the preliminary method of handling such a device is a powerful tool since it enables tracking the participants' approach which is likely to predict their behavior to a considerable extent (Cools et al., 2009).

The relatively few in-depth interviews and observations conducted are liable to be a limitation on the research. At the same time, it is important to stress that the number of participants in qualitative case studies is not large usually. In research based on qualitative content analysis, the main way to examine phenomena and processes is examination of the individual's experience, as part of the group researched. Cautious preliminary conclusions may be drawn from a small sample regarding the general phenomenon (Stake, 1995).

One of the questions that is likely to indicate a research limitation is whether one can, as a rule, assume that the learning and the learning performance with the technological system are linked to the participants' learning approach. Each participant has personal attributes such as differing background and orientation, intellectual skills and so on, that are also likely to affect coping with Nova 5000. Indeed, diverse interrelated components, that cannot be isolated, affect the learning. The unequivocal findings in this study, according to which most of the subjects analyzed a new Talmudic issue using the learning approach with which they were familiar, supports the concept that the approach has a significant impact on their learning. This study directs the spotlight on the learning approach as one of the factors influencing learning. As described in the theoretical background, diverse studies show that the learning approach affects the learning style, shaping thought.

Two additional studies concern us recently. One aims to explore whether the learning approaches (both the SDS and the LC approach) influence different learning strengths. Another study will deal with testing learners who do not apply either approach and compare their coping with Nova 5000 to the two groups tested in this study.

In view of the growing dependence on technology in teaching and learning, the research findings are increasing the need to consider the learning approaches that will encourage diverse learning. These will afford an advantage to educated learning with new learning systems and changing learning environments.

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