Conceptions of learning versus conceptions of web-based learning: The differences revealed by college students

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Abstract

Past research has shown the variations of students' conceptions of learning, but little has been especially undertaken to address students' conceptions of web-based learning and to make comparisons between students' conceptions of learning in general and their conceptions of web-based learning in particular. By interviewing 83 Taiwanese college students with some web-based learning experiences, this study attempted to investigate the students' conceptions of learning, conceptions of web-based learning, and the differences between these conceptions. Using the phenomenographic method of analyzing student interview transcripts, several categories of conceptions of learning and of web-based learning were revealed. The analyses of interview results suggested that the conceptions of web-based learning were often more sophisticated than those of learning. For example, much more students conceptualized learning in web-based context as pursuing real understanding and seeing in a new way than those for learning in general. This implies that the implementation of web-based instruction may be a potential avenue for promoting students' conceptions of learning. By gathering questionnaire responses from the students, this study further found that the sophistication of the conceptions toward web-based learning was associated with better searching strategies as well as higher self-efficacy for web-based learning.

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1. Introduction

"Learning" shapes the main ideas of educational practice. Numerous educational researchers have investigated many aspects of learning, such as learning strategies, learning environments, learning motivation, conceptual development, as well as cognitive growth during learning (e.g., Gaigher, Rogan, & Braun, 2007; Lycke, Grottum, & Stromso, 2006; Spinath & Spinath, 2005; Tolhurst, 2007). It is a fundamental belief that when educators gain a full understanding of student learning, they can design better teaching, curricula or instructional environments for learners. Recently, a growing research interest which has emerged is the exploration of another aspect of learning, that is, students' conceptions of learning. The conceptions of learning, guiding students' primary beliefs about the experiences of learning as well as their interpretations of learning itself, have been found to be related to their approaches to learning and learning outcomes (e.g., Burnett, Pillay, & Dart, 2003; Chin & Brown, 2000). Research also indicates that different learners may have quite different conceptions of learning (e.g., Eklund-Myrskog, 1998; Lin & Tsai, 2009; Lonka, Joram, & Bryson, 1996). The differences in conceptions of learning are associated with the success of learning (Ellis, Goodyear, Prosser, & Calvo, 2008; Reid, Wood, Smith, & Petocz, 2005).

The earliest research work about conceptions of learning may be traced to the study conducted by Saljo (1979). Based on a more complete and detailed analysis of students' responses to their views about learning, later called as the phenomenographic method by Marton (1981, 1986), Saljo (1979) distinguished five qualitatively different categories of conceptions of learning, including "memorizing", "increase of knowledge", "acquisition of facts, procedures that can be retained and/or utilized in practice", "abstraction of meaning", and "an interpretative process aimed at the understanding of reality". Following Saljo, some researchers (e.g., Eklund-Myrskog, 1998; Klatter, Lodewijks, & Aarnoutse, 2001; Lin & Tsai, 2008; Marshall, Summer, & Woolnough, 1999; Marton, 1994; Tsai, 2004a) have investigated the conceptions of learning held by different groups of students in a variety of educational contexts, mainly at the higher education level. For example, Eklund-Myrskog (1998) explored a group of college students' conceptions of learning, and revealed the following categories: "remembering", "understanding", "applying knowledge", "getting a new perspective" and "forming a conception of one's own". Tsai (2004a), by elaborating on 120 Taiwanese high school students' interview responses particularly related to learning science, found the conceptions of...
memorizing”, “preparing for tests”, “calculating and practicing tutorial problems”, “the increase of knowledge”, “applying”, “understanding”, and “seeing in a new way”. Despite the fact that these studies were undertaken with different groups of students, their categories of conceptions of learning could be regarded as a revised or extended version of those proposed by Saljo (1979). In addition, the phenomenographic method, which integrates interview, protocol and discourse analyses, has often been utilized to reveal students’ qualitatively different, hierarchically related, conceptions of learning, and is frequently employed in this line of research (Richardson, 1999). One of the purposes of this study was to investigate a group of Taiwanese college students’ conceptions of learning by way of interviews, and the phenomenographic approach was then adopted to analyze the interview responses with the aim of identifying their conceptions of learning.

Moreover, research in conceptions of learning has also found that students’ conceptions of learning are related to their educational or curricular backgrounds. The studies by Eklund-Myrskog (1997,1998) and Marshall et al. (1999) supported this claim, as they found that students with different majors, such as nursing, engineering or science, expressed quite different conceptions of learning. Tsai (2004a) also found that the interviewed high school students experiencing different curricular programs expressed quite different conceptions of learning. However, not much research has explored another interesting research question, that is, how the students may conceptualize learning in different curricular contexts. For example, students may have quite different conceptions of learning in general and of web-based learning in particular. Therefore, this study hypothesized that students’ conceptions of learning were related to where the learning was occurring, consistent with the perspective of Ellis, Steed, and Applebee (2006) and Makoe, Richardson, and Price (2008). That is, conceptions of learning are contextually dependent, and thus some differences may exist between students’ conceptions of learning in general and those of web-based learning. By analyzing a group of students’ conceptions of learning in general and their conceptions of web-based learning in particular, this study was conducted to examine this hypothesis.

In this decade, web-based learning is suggested for facilitating education practice (e.g., Chou & Tsai, 2002; Jonassen, Peck, & Wilson, 1999; Wallace, 2004). Numerous studies also show the effectiveness as well as the usefulness of web-based learning, such as facilitation of knowledge construction or enhancement of social skills (e.g., Engelberg & Sjoberg, 2004; Linn, Clark, & Slotta, 2003). Although appropriate conceptions or attitudes toward web-based learning should be a prerequisite for fostering web-based instruction (e.g., Roberts, 2003; Yang & Tsai, 2008), not many studies have explored students’ conceptions of web-based learning. In its current stage, web-based instruction or curriculum is implemented more often in higher education settings, as higher education institutes tend to have sufficient facilities and an actual need for it (due to the large number of students enrolled). A careful exploration of college students’ conceptions of web-based learning is indeed in urgent need, since these conceptions are expected to be related to their learning approaches and outcomes in web-based instruction (Ellis & Calvo, 2006; Ellis, Goodyear, Prosser, & O’Hara 2006; Ellis et al. 2008).

This study, hence, also examined how students’ conceptions of web-based learning may play a role in their behaviors or outcomes in web-based learning settings. To explore this issue, two variables were considered in this study. The first one is regarding the students’ searching strategies for web-based learning. Research has shown that the sophistication of using online searching strategies is positively related to their outcomes in web-based learning task (Lin & Tsai, 2007; Tsai, 2008; Tu, Shih, & Tsai, 2008). The second factor evaluated in this study is the self-efficacy of web-based learning. “Self-efficacy” refers to an individual’s beliefs, confidence and expectations in his/her competence to complete a task (Bandura, 1977, 1996), and it has been found that an individual’s self-efficacy about learning is significantly related to his/her learning behaviors and performance (Lane, Lane, & Kyrianniou, 2004). By assessing the students’ self-efficacy of web-based learning, the researchers can acquire some indications about their expected outcomes derived from web-based learning.

Consequently, based on interviews and questionnaire results of 83 college students in Taiwan, the research questions of this study included:

- Through phenomenographic method, what are the categories of conceptions of learning and conceptions of web-based learning expressed by the students?
- What are the student distributions among the categories of conceptions of learning and web-based learning? How may the students’ majors or genders play a role in these conceptions?
- What are the possible differences between the students’ conceptions of learning and web-based learning?
- How may the students’ conceptions of web-based learning play a role in their searching strategies and self-efficacy for web-based learning?

It should be noted again that this study used college students as the research sample because they were more likely to have opportunities to experience web-based instruction. Most higher education institutes in Taiwan are still in the early stage of adopting web-based instruction; therefore, a better understanding of the students’ conceptions of web-based learning is quite necessary.

2. Method

2.1. Sample

The sample of this study included 83 college undergraduate students in Taiwan. They came from six different universities across various demographic areas in Taiwan. These universities offer degree-programs from bachelor to doctorate level, but the sample students in this study were all in bachelor programs. Eighteen of them were freshmen, 25 sophomores, 21 juniors, and 19 seniors. The average age was 20.4. They were selected because they all had experience of participating in courses assisted by web-based instruction. In these courses (including both compulsory and elective courses), they were allowed to interact with peers and the course teachers online using specific e-learning platforms both synchronously and asynchronously. Also, they were encouraged to explore rich online resources relevant to the courses, and were not just limited to the materials provided by the textbook or course handouts. These instructional features were quite different from those of the regular standard courses they were taking, which mainly used textbooks and one-way lecturing. In regular courses, the role of the teacher is often as an information provider who asserts his/her authority, while teacher–student and peer interactions are rare.
Among the selected students, 45 were science-related majors (such as chemistry, physics, engineering, medicine), while 38 were arts-oriented majors (such as language, social work, psychology, communication, history, music). Gender distribution was almost equal (43 males versus 40 females). Therefore, this study tried to cover the undergraduate college student sample across different areas, grade levels, majors and both genders.

2.2. Data collection of the interview

To explore the students’ conceptions of learning and conceptions of web-based learning, the research data were gathered from the interviews with the sample students. Each student was individually interviewed by a trained researcher. The interviews were conducted in a semi-structured way. Moreover, similar to the way conducted by Tsai (2002), in order to avoid contamination of responses across the conceptions of learning and of web-based learning, the interview for each student was conducted twice – once to ascertain his or her conceptions of learning and the second time for his or her conceptions of web-based learning. This also avoided the situation that the students directly perceived some connections among these two types of conceptions. The period between these two interviews for each student was about one to two weeks. One may suggest a longer period between these two interviews to reduce the possible memory effects, but the students might become unreachable if the period between two interviews was longer. Each interview took about 10–15 min. The researcher was not limited in time while interviewing students. It was that, according to the researcher’s experience, students would be weary of the questions if the interview lasted more than 15 min. The same researcher, with rich experiences of conducting interview, interviewed all of the students.

The guiding interview questions for assessing conceptions of learning in general were basically modified from the studies undertaken by Marshall et al. (1999), Tsai (1998, 2004a) and Tsai and Kuo (2008), as presented below:

- What do you mean by “learning”?
- How do you know when you have learned something?
- How do you learn?
- Please describe a situation in which you think you are learning.

The interview questions for probing conceptions of web-based learning were quite similar, such as:

- What do you mean by “web-based learning”?  
- How do you know when you have learned something in a web-based context?  
- How do you learn in a web-based context?  
- Please describe a situation in which you think you are learning in a web-based context.

All of the individual interviews were audio-recorded. The interviews were administered in Chinese and then fully transcribed for further analysis. The verbatim transcripts of student interviews were the primary data sources used to reveal the students’ conceptions of learning and their conceptions of web-based learning.

2.3. Data analysis of the interview

The analysis of the verbatim transcripts of student interviews was processed using the phenomenographic method. The phenomenographic method, combining interview, protocol and discourse analyses, is frequently used to identify student qualitatively different, hierarchically related, conceptions of learning (Richardson, 1999). By following the analytical procedures employed by Eklund-Myrskog (1998) and Tsai (2004a), for each student's interview transcripts, the researcher marked the most important sentences and highlighted some keywords that exemplified the student’s views of learning or web-based learning. Then, the content specific similarities and differences of the underlined sentences and keywords across different students’ interview replies about their views of learning or web-based learning were explored and summarized. Therefore, when analyzing the interview data gathered by the phenomenographic method, the consistencies and differences essentially across rather than within the students’ responses were carefully examined (Marton, Watkins, & Tang, 1997). By a process of contrasting the similarities as well as differences across students’ main ideas, some “qualitatively different” categories of description that were used to classify the students’ conceptions of learning or web-based learning were developed. It should be noted that the procedure above was undertaken, respectively for students’ conceptions of learning and their conceptions of web-based learning. In sum, the purpose of the phenomenographic analysis in this study was to reveal some categories of description that could characterize the qualitatively different perspectives in which learning or web-based learning was conceptualized by the interviewed students. The researcher can construct some categories of conceptions of learning as well as conceptions of web-based learning. Based on the previous research literature (e.g., Marton, Dall’Alba, & Beatty 1993; Saljo, 1979; Tsai, 2004a), these conceptions, such as “memorizing”, “applying”, and “understanding”, could be perceived in a hierarchical order.

Moreover, in order to better represent the students’ conceptions of learning, their interview responses were categorized into “main” and “achieved” levels. The “main” conception of learning, similar to the method utilized by Tsai (2004a), was used to represent the central ideas expressed by each student’s interview responses. On the other hand, the “achieved” conception of learning indicated the highest-order category of conception of learning addressed by the student. For example, one student expressed his ideas about learning as follows:

I think learning requires a lot of memorization. There are a lot of terms, laws, principles, theories or knowledge to be memorized. These will all appear on the tests. As I am not a person with a good memory, I may not be a good learner. But, if I can store all of these in my memory, certainly, my knowledge is increased. And, this is learning.

Based on the interview transcript above, the student was clearly attached to the “memorizing” conception of learning, as his ideas about learning were mainly associated with “memorization,” “memory” and “storage”. (This is also an example showing the phenomenographic method for classifying student conceptions of learning.) However, he also showed, though not strongly, a view that learning is an increase
in knowledge. The “increase” conception of learning, on the basis of research work of Tsai (2004a) and Lee, Johanson, and Tsai (2008), should be a higher-order category of the learning conception than “memorizing”. Therefore, his “main” conception of learning was coded as “memorizing”, but his “achieved” conception was labeled as “increase”. (Detailed descriptions and definitions of the categories of conceptions of learning will be presented later.) Certainly, if a student expresses quite consistent views within a category of conceptions of learning, his or her “main” conception would be the same as the “achieved” conception. This study holds that for the students with the same category of “main” conception of learning, those who possess a higher-order category of “achieved” conception may be more equipped to achieve more sophisticated higher-order conceptions of learning. Therefore, with the additional analysis of the “achieved” conception of learning, researchers can differentiate the students’ conceptions of learning more finely, especially for the students categorized into the same category of conceptions of learning with similar major ideas but with subtle differences.

Some previous research into students’ conceptions of learning has found that students might convey their conceptions of learning across different categories (e.g., Lee et al., 2008; Marton, Dal’Alba, & Beatty, 1993). The usage of “main” and “achieved” conceptions may provide an alternative way of analyzing the students’ conceptions of learning blended with various ideas. This way of categorizing students’ ideas corresponds to that employed by Carey, Evans, Honda, Jay, and Unger (1989). In their study, the students’ views about the nature of science, gathered through interviews, were scored from 0 to 3 levels, basically from naive to more advanced. They used a “mean” score to represent each student’s major ideas about the nature of science, and a “high” score to denote his or her highest-level view of the nature of science. Therefore, one student may have mean score of 1 but a high score of 2. The use of “main” and “achieved” conceptions can be regarded as a parallel of their study. Using a similar method, the students’ conceptions of web-based learning were analyzed by “main” and “achieved” levels. This way of analyzing students’ conceptions of learning was exactly utilized by Yang and Tsai (in press), allowing the identification of predominant conceptions as well as the highest-level these conceptions represent. As suggested by Yang and Tsai (in press), the distinction between main and achieved levels possibly displays the zone of proximal development (Vygotsky, 1978) of each student.

The process of categorizing each student’s conceptions of learning and of web-based learning was performed by an expert researcher, and a second independent researcher validated the categorization of 20 participants’ interview responses. The agreement between these two researchers reached 0.88, indicating fairly acceptable reliability of classifying the students’ conceptions of learning and of web-based learning.

2.4. Questionnaire about searching strategies and self-efficacy about web-based learning

As one of the research purposes was to examine the role of the students’ conceptions of web-based learning in their searching strategies and self-efficacy of web-based learning, this study administered a questionnaire, consisting of three scales, to all of the participants.

The first two scales, by adapting those developed by Wu and Tsai (2005, 2007), were used to assess the students’ searching strategies for web-based learning, described below:

- “Exploration” searching strategy (five items): indicating that learners have purposeful thinking when searching information in the web-based learning environments, and try to meaningfully integrate online information when engaged in web-based learning. Sample item: When I search information when engaged in web-based learning, I can keep reminding myself about the purpose of my online searching.
- “Match” searching strategy (five items): indicating that the web-based learners are eager to match their searching purposes by finding only a few web sites that contain the most relevant information. Sample item: When I search information during the process of web-based learning, if I find the first relevant Web site, I will not search others.

According to the research by Tsai (2004b) and Liang and Tsai (2009), “exploration” is viewed as more sophisticated searching strategy for web-based learning, while “match” is a less advanced one.

The third questionnaire scale assessed the students’ self-efficacy toward web-based learning. A total of eight items, modified from Moos and Azevedo (2008) and Pintrich, Smith, Garcia, and McKeachie (1991) were utilized to represent the students’ confidence and expected outcomes of web-based learning. Sample item is “I believe I will receive an excellent score on a web-based learning course”.

These questionnaire items were presented with bipolar strongly agree/strongly disagree statements in a six-point Likert-type scale (i.e., strongly agree, agree, somewhat agree, somewhat disagree, disagree and strongly disagree). The use of six-point Likert scale was to avoid students’ selection of totally neutral position for many items, exactly the same as that used by Wu and Tsai (2005, 2007). The alpha coefficients for the three scales in this study were 0.86, 0.81 and 0.91, respectively, suggesting highly satisfactory internal consistency for assessing the students’ searching strategies and self-efficacy of web-based learning.

2.5. Follow-up interviews

Six of the students in the sample were randomly selected for an additional round of follow-up interviews to explore their ideas about the possible differences between their conceptions of learning in general and of web-based learning. The interviews, conducted independently from those mentioned previously, were carried out individually for each selected student. The interviewer (the same as the one for the previous interview) first asked the questions presented previously about conceptions of learning in general and conceptions of web-based learning to reconfirm their ideas. Then, if the interviewer perceived some differences, he asked some follow-up questions, such as: Is there any important difference between learning in general and web-based learning? What different experiences have you had? How were they different? This follow-up interview lasted 30–60 min for each selected student, and the interviewee was paid for being interviewed.

The purpose of this part of the research was to acquire more ideas about the possible sources of the differences between conceptions of learning and those of web-based learning revealed by the students. Again, all of the interviews were audio-recorded. The interviews were administered in Chinese and then fully transcribed for analysis.
3. Results

3.1. The conceptions of learning and conceptions of web-based learning

In this study, seven categories of conceptions of learning were revealed by the student interview responses. These categories, presented in Table 1, included: learning as memorizing, learning as getting a better status, learning as calculating and practicing, learning as an increase in knowledge, learning as applying, learning as understanding, and learning as seeing in a new way. In addition, students’ conceptions of web-based learning was a subset of their conceptions of learning in general, only including “increase”, “applying”, “understanding” and “seeing in a new way”. These categories were similar to those found by Tsai (2004a) for Taiwanese high school conceptions of learning science. However, some slight modifications or new ideas among these categories were made in this study.

First, the conception of learning as getting a better status, originally learning as preparing for tests or learning as getting a better score in tests in Tsai (2004a), is now extended. In the category of getting a better status, the students, similar to those in Tsai (2004a), expressed the idea that learning was preparing for tests and attaining high grades in courses. However, as the sample in this study included college students who might be employed in the not-too-distant future, they held a more pragmatic view of learning, conceptualizing it as a way of getting a better future job. Some of them also stated the linkages among good scores, academic degree and job availability. For instance, one student replied that:

Successful learning is indicated by good scores. Good scores help you enter good schools and get a better degree. Finally, by these records, you can have a better job for earning more money. This is my major idea about learning.

Table 1
The categories of conceptions of learning and conceptions of web-based learning with interview examples.

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
<th>Interview examples for conceptions of learning</th>
<th>Interview examples for conceptions of web-based learning</th>
</tr>
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<tbody>
<tr>
<td>Memorizing</td>
<td>Learning is conceptualized as memorizing related knowledge. A careful storage of knowledge is the key for learning</td>
<td>- Learning involves a lot of memorization. While learning, a lot of terms, definitions, formula, facts and theories need to be memorized</td>
<td>-</td>
</tr>
<tr>
<td>Status</td>
<td>Learning is conceptualized as attaining better status, such as higher course grades, academic degrees, or better future jobs</td>
<td>- Learning is for better grades in tests. When I get good grades in tests, I know I am learning and I really learn something. Learning is for a better degree. Then, I can find a better future job&lt;br&gt;- Learning can help me gain a better status, and then I can earn more money</td>
<td>-</td>
</tr>
<tr>
<td>Calculating and practicing</td>
<td>Learning is conceptualized as a series of calculations, homework exercises and practices of solving problems</td>
<td>- Learning involves a series of calculations, tutorial problem-solving and practices. That’s what learning is about&lt;br&gt;- Learning requires intensive practice. Without practice, you cannot learn well</td>
<td>-</td>
</tr>
<tr>
<td>Increase</td>
<td>Learning is conceptualized as an increase of knowledge. Learning indicates an extension of prior knowledge</td>
<td>- Learning is an increase of knowledge. I feel I am learning when I have more and more knowledge&lt;br&gt;- Learning indicates an accumulation of knowledge. That is, good learning yields an accumulation and better collection of knowledge</td>
<td>- Web-based learning helps me enlarge my knowledge base. I know more information and knowledge&lt;br&gt;- The most important thing for web-based learning is to help someone acquire more information and knowledge in a very efficient way</td>
</tr>
<tr>
<td>Applying</td>
<td>Learning is conceptualized as successful applications of acquired knowledge. Learning needs to solve real problems and possibly to make contributions to one’s community</td>
<td>- Learning is to acquire related knowledge and skills to solve real-life problems&lt;br&gt;- The main purpose of learning is to apply knowledge. By applying knowledge, we can have more advanced inventions, making contributions to society</td>
<td>- Web-based learning involves more applications of knowledge, not just some theoretical concepts listed in the textbooks&lt;br&gt;- In my view, web-based learning connects more theoretical knowledge to real-life situations. We can use the knowledge more effectively in practical contexts. We can use the knowledge to generate more products to enhance people’s life</td>
</tr>
<tr>
<td>Understanding</td>
<td>Learning is conceptualized as the development of true understanding of knowledge. Learning can acquire more integrated knowledge of greater breadth and depth</td>
<td>- Learning is for true understanding, not just memorization&lt;br&gt;- Learning must engage in understanding. Knowing the sources of knowledge will enhance understanding&lt;br&gt;- If I have an integrated understanding of a certain topic, I would say that I have really learned the topic</td>
<td>- By web-based learning, I can acquire knowledge of great breadth and depth. Then, I get better understandings&lt;br&gt;- In web-based learning environments, I can explore the learning materials from different sources, and then I acquire a more complete understanding</td>
</tr>
<tr>
<td>Seeing in a new way</td>
<td>Learning is conceptualized as interpreting phenomena, things, events in new perspectives. This conception also implies the importance of the unity of life and knowing.</td>
<td>- Learning helps me look at many things and events from new perspectives&lt;br&gt;- Learning provides me with new thoughts about a lot of things surrounding me</td>
<td>- Web-based learning helps me understand something in a totally different perspective&lt;br&gt;- By web-based learning, we can know more about various points of views, and then adapt to our life more easily. I think the unity of life and knowing is the ultimate goal of learning, and I think web-based learning can effectively help this</td>
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</table>
Based on the interview responses, this study modified the category “preparing for tests” in Tsai (2004a) into a new category, “getting a better status”. According to this category, learning is conceptualized as having good scores, degrees and career opportunities.

In addition, some of the students in the category of “application” expressed the view that learning indicated profitable applications of acquired knowledge, which should eventually make contributions to society. This conception of learning has also been documented in the studies of some Chinese learners (Li, 2001, 2003). However, this view was not found amongst high school students in Tsai’s (2004a) study. Perhaps this difference is because the sample in this study consisted of college students who might be gradually recognizing their mission within the whole community. As this idea was strongly based upon their conception of the “application of knowledge for learning”, it was merged into the “application” category.

Finally, for the category of “seeing in a new way”, some of the college students highlighted “lifelong” learning since learning always brings new ways of thinking for interpreting the happenings around us. Two students in this category further claimed that learning was trying to unify life and knowing. These ideas have not often been found in previously related studies.

3.2. The distribution of learning conceptions

As found by previous research about students’ conceptions of learning, their conceptions might be across different categories (e.g., Lin & Tsai, 2008; Marton, Dall’Alba, & Beaty, 1993). For instance, Table 2 presents the most original distribution of the conceptions of web-based learning held by the students.

According to Table 2, 42 among the 83 interviewed students (50.6%) expressed only one category of conceptions of web-based learning during their interviews. The rest of them had more than one category. For example, sixteen students held the conceptions of web-based learning mixing with the categories of “increase” and “applying” and there was one student possessing four categories of conceptions of web-based learning. Although the data presented in Table 2 may provide a more thorough view about the students’ conceptions of web-based learning, but the data were difficult to become amenable to further quantitative analyses. Therefore, recent studies for this research topic still classified each student’s conception of learning into one category only (e.g., Ellis, Hughes, Weyers, & Riding, 2009; Ellis et al., 2008). In order to keep a certain representation of the students’ conceptions with multiple allocations to different categories as well as to possibly conduct further statistical analyses, as mentioned previously, this study coded each student’s conceptions of learning (or web-based learning) into “main” and “achieved” levels, representing the predominant conception and the highest-order conception each student expressed in the interview. For each level, one category was assigned to each student. For example, among the sixteen students expressing both “increase” and “applying” conceptions of web-based learning, nine of them had their “main” conception of web-based learning as “increase”, while the rest of them were coded as “applying”. That is, even all of them expressed both “increase” and “applying” conceptions, they might be coded differently by the “main” level. However, the “achieved” conception of web-based learning for all of these sixteen students was “applying”, as “applying” was the highest-order category of conceptions of web-based learning expressed by these students. As aforementioned, the “achieved” level was intended to display the student’s potential idea. For example, the 9 among the 16 “increase/applying” students were coded as “increase” in the “main” level, but “applying” in the “achieved” level. They were expected to have more potentially advanced ideas about the conceptions of web-based learning than the 15 students (in the first row of Table 2) who expressed the conceptions of web-based learning only in the “increase” category (for these 15 students, their “main” and “achieved” conceptions of web-based learning are both coded as “increase”). It is hoped that by using the “main” and “achieved” levels, the researcher can have a finer representation about each student’s conceptions, and such representation can also be amenable to some statistical analyses.

Consequently, each student was classified into a category according to his or her interview responses to display his or her major conceptions of learning and web-based learning respectively, called “main” conceptions. The distribution of the students’ “main” conceptions of learning as well as their conceptions of web-based learning is presented in Table 3.

Among the 83 interviewed students, ten and eleven students expressed their “main” conceptions of learning as “status” and “calculating”, respectively. The categories of “increase”, “applying” and “understanding” seemed to be the major conceptions of learning held by the students (n = 20, 15 and 17, respectively). On the other hand, for the “main” conceptions of learning, particularly for the web-based context, none of the students’ conceptions were categorized as “memorizing”, “status” or “calculating”. Most of the students, when being asked about their views of web-based learning, conveyed the conceptions of “increase”, “applying”, and “understanding” (n = 29, 21, 22, respectively). Also, 11 students expressed “seeing in a new way” as their conception of web-based learning.

<table>
<thead>
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<th>Table 2</th>
<th>The students’ conceptions of web-based learning.</th>
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<td>N</td>
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<tr>
<td>Increase</td>
<td>15</td>
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<tr>
<td>Applying</td>
<td>10</td>
</tr>
<tr>
<td>Understanding</td>
<td>10</td>
</tr>
<tr>
<td>Seeing in a new way</td>
<td>7</td>
</tr>
<tr>
<td>Increase–applying*</td>
<td>16</td>
</tr>
<tr>
<td>Increase–understanding</td>
<td>4</td>
</tr>
<tr>
<td>Applying–understanding</td>
<td>3</td>
</tr>
<tr>
<td>Increase–applying–understanding</td>
<td>3</td>
</tr>
<tr>
<td>Increase–seeing in a new way</td>
<td>4</td>
</tr>
<tr>
<td>Applying–seeing in a new way</td>
<td>3</td>
</tr>
<tr>
<td>Understanding–seeing in a new way</td>
<td>5</td>
</tr>
<tr>
<td>Applying–understanding–seeing in a new way</td>
<td>2</td>
</tr>
<tr>
<td>Increase–applying–understanding–seeing in a new way</td>
<td>1</td>
</tr>
</tbody>
</table>

* This indicates that the students expressed both “increase” and “applying” conceptions of web-based learning. Similar rules are applied to other representations.
As discussed previously, this study also categorized students’ conceptions of learning or web-based learning by the highest-order mentioned in the interview responses, that is, their “achieved” conceptions. The distribution of students’ “achieved” conceptions of learning and web-based learning is presented in Table 4.

According to the results shown in Table 4, similar to the “main” conceptions, most students expressed the “achieved” conceptions of learning as “increase”, “applying” and “understanding” (n = 19, 18 and 21). However, the highest frequency of the “main” conceptions of learning was “increase” (n = 20 in Table 3), whereas the highest frequency for “achieved” was found to be “understanding” (n = 21 in Table 4). It is of note that as many as 22 students disclosed the “seeing in a new way” conception of web-based learning at the “achieved” level, but only 11 students expressed the same view at the “main” level. For the “achieved” conceptions of web-based learning, the highest frequency was “applying” (n = 26), but “increase” was the top “main” conception of web-based learning (n = 29 in Table 3). All of these showed clear enhancement of conceptions of learning or conceptions of web-based learning from the “main” level to the “achieved” level.

### Table 3

<table>
<thead>
<tr>
<th>Category</th>
<th>Conceptions of learning n,%</th>
<th>Conceptions of web-based learning n,%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memorizing</td>
<td>5 (6.0%)</td>
<td>0</td>
</tr>
<tr>
<td>Status</td>
<td>10 (12.0%)</td>
<td>0</td>
</tr>
<tr>
<td>Calculating</td>
<td>11 (13.3%)</td>
<td>0</td>
</tr>
<tr>
<td>Increase</td>
<td>20 (24.1%)</td>
<td>29 (34.9%)</td>
</tr>
<tr>
<td>Applying</td>
<td>15 (18.1%)</td>
<td>21 (25.3%)</td>
</tr>
<tr>
<td>Understanding</td>
<td>17 (20.5%)</td>
<td>22 (26.5%)</td>
</tr>
<tr>
<td>Seeing in a new way</td>
<td>5 (6.0%)</td>
<td>11 (13.3%)</td>
</tr>
</tbody>
</table>

### Table 4

<table>
<thead>
<tr>
<th>Category</th>
<th>Conceptions of learning n,%</th>
<th>Conceptions of web-based learning n,%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memorizing</td>
<td>2 (2.4%)</td>
<td>0</td>
</tr>
<tr>
<td>Status</td>
<td>5 (6.0%)</td>
<td>0</td>
</tr>
<tr>
<td>Calculating</td>
<td>8 (9.6%)</td>
<td>0</td>
</tr>
<tr>
<td>Increase</td>
<td>19 (22.9%)</td>
<td>15 (18.1%)</td>
</tr>
<tr>
<td>Applying</td>
<td>18 (21.7%)</td>
<td>26 (31.3%)</td>
</tr>
<tr>
<td>Understanding</td>
<td>21 (25.3%)</td>
<td>20 (24.1%)</td>
</tr>
<tr>
<td>Seeing in a new way</td>
<td>10 (12.0%)</td>
<td>22 (26.5%)</td>
</tr>
</tbody>
</table>

As discussed previously, this study also categorized students’ conceptions of learning or web-based learning by the highest-order mentioned in the interview responses, that is, their “achieved” conceptions. The distribution of students’ “achieved” conceptions of learning and web-based learning is presented in Table 4.

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#### 3.3. Conceptions of learning and web-based learning by different majors, genders and seniority

As described previously, this study included science-major and art-major college students. It is interesting to find whether the major might play a role in the conceptions of learning and those web-based learning. Table 5 shows the “main” conceptions of learning and web-based learning sorted by different majors.

The results in Table 5 show that the students of science and art majors displayed statistically similar distributions across different categories toward the “main” conceptions of learning (Chi-square = 2.63, n.s.). For example, many science majors and art majors had their “main” conceptions toward learning categorized as “increase”, “applying” and “understanding”. Similarly, for the conceptions toward web-based learning, the student distributions across the categories were not significantly different between science and art majors (Chi-square = 0.42, n.s.). Table 6 presents a parallel analysis for students’ “achieved” conceptions.

Table 6 shows some interesting findings for students’ “achieved” conception of learning. When examining the conception distribution between science majors and art majors, it was found that these two groups of students revealed significantly different patterns (Chi-square = 13.52, p < .05). The major differences came from that more science majors expressed “calculating”, “applying” and “understanding” as their “achieved” conception of learning than art majors, whose “achieved” conceptions were more classified as “increase”. This also strengthens the exploration of “achieved” conceptions of learning, as the different specializations may only play a role in “achieved”

### Table 5

<table>
<thead>
<tr>
<th>Category</th>
<th>Conceptions of learning n</th>
<th>Conceptions of web-based learning n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memorizing</td>
<td>2 (Science: 2, Art: 3)</td>
<td>0 (Science: 0, Art: 0)</td>
</tr>
<tr>
<td>Status</td>
<td>6 (Science: 4, Art: 4)</td>
<td>0 (Science: 0, Art: 0)</td>
</tr>
<tr>
<td>Calculating</td>
<td>8 (Science: 3, Art: 3)</td>
<td>0 (Science: 0, Art: 0)</td>
</tr>
<tr>
<td>Increase</td>
<td>10 (Science: 10, Art: 10)</td>
<td>16 (Science: 16, Art: 13)</td>
</tr>
<tr>
<td>Applying</td>
<td>8 (Science: 7, Art: 9)</td>
<td>12 (Science: 12, Art: 9)</td>
</tr>
<tr>
<td>Understanding</td>
<td>9 (Science: 8, Art: 10)</td>
<td>12 (Science: 12, Art: 10)</td>
</tr>
<tr>
<td>Seeing in a new way</td>
<td>2 (Science: 3, Art: 2)</td>
<td>5 (Science: 5, Art: 6)</td>
</tr>
</tbody>
</table>

Notes: Science major n = 45, Art major n = 38.

a Chi-square = 2.63, d.f. = 6, p = 0.85, n.s. between science and art majors.

b Chi-square = 0.42, d.f. = 3, p = 0.94, n.s. between science and art majors.
conceptions, but did not significantly in “main” conceptions of learning. Nevertheless, the analysis for the “achieved” conceptions of web-based learning did not show statistically different patterns between science and art majors (Chi-square = 2.44, n.s.). Students with different majors achieved similar conceptions toward web-based learning.

The same analyses were conducted to examine whether seniority (the grade levels in college) and gender play a role in students’ conceptions of learning or conceptions of web-based learning. It was found that these two factors did not have significant effects on students’ conceptions of learning or web-based learning either in the “main” or “achieved” level.

3.4. Conceptions of learning versus web-based learning

Moreover, this study explored the possible differences between students’ conceptions of learning in general and their conceptions of web-based learning. Table 7 shows all of the possible combinations between students’ conceptions of learning and web-based learning at the “main” level. For example, there were three students who expressed their “main” conceptions of learning as “memorizing”, but their “main” conceptions of web-based learning were categorized as “increase”. A closer examination of the data in Table 7 indicates that of the 83 interviewed students, 31 were consistent in their categories of “main” conceptions of learning and those of web-based learning; eight students had lower-order conceptions of web-based learning than those of learning; as many as 44 students expressed more advanced conceptions of web-based learning than of learning in general. A Wilcoxon Test also confirmed that more students tended to enhance their “main” conceptions of learning in a web-based context, when compared to the conceptions of learning in general (z = 4.854, p < .001).

Table 8 shows a similar analysis for the relationship between students’ “achieved” conceptions of learning and of web-based learning. The results in Table 8 also reveal that 29 students remained the same for these two conceptions, but 44 students enhanced their “achieved”
significantly higher self-efficacy toward web-based learning than those with lower-order (increase and applying). Similar results were found. The students with higher-order conceptions of web-based learning (seeing in a new way and understanding) had learning (i.e., match) than those with the relatively lower-order conception (e.g., increase). For the self-efficacy of web-based learning, sophisticated searching strategy (i.e., exploration) and they were more likely not to use less advanced searching strategy for web-based learning.

In general, the students with higher-order “main” conceptions of web-based learning (e.g., seeing in a new way) tended to have more conceptions from learning in general to web-based learning. The tendency of enhancement from “achieved” conceptions of learning to those of web-based learning was statistically confirmed (Wilcoxon test, z = −4.989, p < .001).

3.5. Conceptions of web-based learning, searching strategies and self-efficacy toward web-based learning

This study further examined the role of the students’ conceptions of web-based learning in some of their behaviors and expected outcomes involved in web-based learning. A questionnaire with three scales was used to assess the students’ searching strategies and self-efficacy of web-based learning. Table 9 shows the results of the students with different “main” conceptions of web-based learning.

Table 9

="Main” conceptions of web-based learning, searching strategies for web-based learning and self-efficacy toward web-based learning.

<table>
<thead>
<tr>
<th>Category</th>
<th>Exploration (mean/S.D.)</th>
<th>Match (mean/S.D.)</th>
<th>Self-efficacy (mean/S.D.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Increase (n = 29)</td>
<td>4.24/0.82</td>
<td>3.41/0.89</td>
<td>3.48/0.78</td>
</tr>
<tr>
<td>(2) Applying (n = 21)</td>
<td>4.63/0.73</td>
<td>3.37/0.65</td>
<td>3.76/0.51</td>
</tr>
<tr>
<td>(3) Understanding (n = 22)</td>
<td>4.84/0.56</td>
<td>3.13/0.82</td>
<td>4.59/0.73</td>
</tr>
<tr>
<td>(4) Seeing in a new way (n = 11)</td>
<td>5.00/0.75</td>
<td>2.55/0.91</td>
<td>4.62/0.58</td>
</tr>
<tr>
<td>F (ANOVA)</td>
<td>4.52**</td>
<td>3.36*</td>
<td>15.03***</td>
</tr>
<tr>
<td>Scheffé test</td>
<td>(3) &gt; (1), (4) &gt; (1)</td>
<td>(1) &gt; (4)</td>
<td>(3) &gt; (1), (3) &gt; (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(4) &gt; (1), (4) &gt; (2)</td>
</tr>
</tbody>
</table>

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Based upon the data presented in Table 9, the students with higher-order “main” conceptions of web-based learning, such as “understanding” and “seeing in a new way” tended to utilize the “exploration” searching strategy than those with relatively lower-order conceptions, “increase” (F = 4.52, p < .01). On the other hand, the “match” searching strategy was significantly more possible to be used by the students with the “increase” conception of web-based learning than those with the “seeing in a new way” conception (F = 3.36, p < .05). In general, the students with higher-order “main” conceptions of web-based learning (e.g., seeing in a new way) tended to have more sophisticated searching strategy (i.e., exploration) and they were more likely not to use less advanced searching strategy for web-based learning (i.e., match) than those with the relatively lower-order conception (e.g., increase). For the self-efficacy of web-based learning, similar results were found. The students with higher-order conceptions of web-based learning (seeing in a new way and understanding) had significantly higher self-efficacy toward web-based learning than those with lower-order (increase and applying).

The same analyses were undertaken to examine the role of the students’ “achieved” conceptions of web-based learning, shown in Table 10. The results in Table 10 are quite similar to those in Table 9, except the result that in the “match” searching strategy, the students having “seeing in a new way” conception of web-based learning showed significantly less tendency to use it than all of the other three conception groups of students (F = 11.25, p < .001). In general, the findings presented in both Table 9 and Table 10 supported the conclusion that higher-order conceptions of web-based learning were associated with better searching strategies as well as higher self-efficacy toward web-based learning.

3.6. The results of follow-up interviews

Finally, six students were chosen for additional follow-up interviews. Among these students, four had more sophisticated conceptions of web-based learning than of learning in general at the “main” level. Two of them had the same conceptions for both. To explore the possible sources of the differences between students’ conceptions of web-based learning and those of learning, the four students’ interview responses of direct comparison between the two were quite informative. Their ideas about the differences between their experiences of web-based learning and learning in general (often in regular courses) were clearly shown in their interview responses, as presented below.

S2: In web-based courses, we can connect to rich resources of learning materials. By accessing these resources, we can get more practical examples. But, in traditional learning, we can only comprehend the concepts at an abstract level.

S3: In web-based learning, I have a lot of online interactions with class peers, teaching assistants and the professor. Through these interactions, my ideas become clearer, and more integrated. I accumulate more knowledge. Also, I can get different ways of knowing the same concept; I think it is quite helpful.

Table 10


<table>
<thead>
<tr>
<th>Category</th>
<th>Exploration (mean/S.D.)</th>
<th>Match (mean/S.D.)</th>
<th>Self-efficacy (mean/S.D.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Increase (n = 15)</td>
<td>3.97/0.86</td>
<td>3.59/0.88</td>
<td>3.35/0.98</td>
</tr>
<tr>
<td>(2) Applying (n = 26)</td>
<td>4.53/0.78</td>
<td>3.54/0.65</td>
<td>3.69/0.54</td>
</tr>
<tr>
<td>(3) Understanding (n = 20)</td>
<td>4.78/0.60</td>
<td>3.35/0.74</td>
<td>4.43/0.73</td>
</tr>
<tr>
<td>(4) Seeing in a new way (n = 22)</td>
<td>4.94/0.46</td>
<td>2.45/0.69</td>
<td>4.40/0.72</td>
</tr>
<tr>
<td>F (ANOVA)</td>
<td>6.55**</td>
<td>11.25***</td>
<td>10.12</td>
</tr>
<tr>
<td>Scheffé test</td>
<td>(3) &gt; (1), (4) &gt; (1)</td>
<td>(1) &gt; (4), (2) &gt; (4), (3) &gt; (4)</td>
<td>(3) &gt; (1), (3) &gt; (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(4) &gt; (1), (4) &gt; (2)</td>
</tr>
</tbody>
</table>

** p < 0.01.

*** p < 0.001.
S5: My own experiences of learning in the past focused mainly on examinations and the practice of “abstract” tutorial problems. When I experienced some web-based courses, I found that learning became more authentic, related to real-life. (Researcher: Why?) Maybe we can have more chances to know more from different perspectives by the assistance of the web. (Researcher: How?) By some related web learning resources and by online learning peers.

S6: Compared to learning in conventional settings, web-based learning helps me gain a better understanding of the learning materials. (Researcher: How?) By digging for online information. In fact, I spent much more time when taking web-assisted courses in order to know more about the learning materials. As web-based instruction contains many learning resources and allows much flexibility for my learning, I need to have more self-paced learning to gain an integrated understanding of the instructional topic. This is quite different from the conventional way of learning.

The above results clearly show that these students perceived web-based learning quite differently from what they experienced in conventional classroom settings, a similar finding to that revealed by Goodyear, Jones, Asensio, Hodgson, and Steeplps (2005). The above students’ reflections of web-based learning focused on three major perspectives: the web as an information resource for learning (e.g., S2 student), the web for individual self-paced learning (e.g., S6 student), and the web for more interactions and dialogues (e.g., S3). These perspectives were quite consistent with the conceptions of teaching using the web expressed by university staff involved in web-based instruction in Roberts’ (2003) study. Based on the interview results above, it was concluded that web-based learning can provide plentiful sources of knowledge, numerous examples in authentic contexts, more ways of understanding the learning content and a variety of alternatives for knowing or interpreting. Therefore, it is plausible that more students in this study conceptualized web-based learning as “applying” and “seeing in a new way”.

4. Discussion and conclusions

Research has indicated the importance of students’ conceptions of learning on learning, and sophisticated conceptions (e.g., “understanding”, “seeing in a new way”) are positively correlated with better quality of learning (e.g., Ellis et al., 2008; Marton, Dall’Alba, & Beaty, 1993; Purdie & Hattie, 2002; Purdie, Hattie, & Douglas, 1996; van Rossum & Schenk, 1984). Therefore, teachers should gain a better understanding of their students’ conceptions of learning. In addition, this study revealed that students’ conceptions of learning may depend on the curricular contexts, such as web environments in this study. This perspective is consistent with that proposed by Makeke et al. (2008), who asserted the context dependence for conceptions of learning. Researchers and teachers, especially in higher education, may explore students’ conceptions in different curricular contexts (such as the traditional classroom, laboratory, intern workplace, or web-based environments), and try to find better ways of fostering students’ conceptions of learning in general, as well as those in some special contexts. Some findings revealed by this study may provide initial thoughts about this.

For example, the results of this study indicate that the college students’ conceptions of web-based learning were often more sophisticated than those of learning in general. This implies that the implementation of web-based curricula may be a potential avenue of promoting students’ conceptions of learning, especially in higher education. This inference also strengthens the use of web-based instruction for educational practice. Past research has concluded that web-based instruction can help students attain cognitive and social skills, develop more integrated knowledge structures, as well as facilitate their reflective thinking and problem solving skills (e.g., Crippen & Boyd, 2007; Engelberg & Sjoberg, 2004; Linn et al., 2003; Rafaeli, Barak, Dan-Gur, & Toch, 2004; Seale & Cann, 2000; Tsai, 2004c). This study has advanced these findings by hypothesizing that web-based instruction may be a way of enhancing students’ conceptions of learning. Future studies may be conducted to explore the possible progression of students’ conceptions of learning when actually involving web-based instruction, and the students may experience the process of “conceptual change” regarding their conceptions of learning.

This study presented evidence that students’ conceptions of learning differed from those of web-based learning. This suggests that the students might make some distinction between school knowledge and knowledge in different contexts. Formal schooling or the knowledge in the schools, for some students, may be conceptualized as more fixed, requiring certain answers, and unrelated to real-life. These ideas expressed by students have been documented in the literature (e.g., Bonotto, 2001; Pepin, 1998; Tsai, 1998). Although this study explored students’ conceptions of learning in general by individual interviews, it is quite probable that students had school learning in mind, due to the fact that the interviews were carried out at school or were at least connected with school. The knowledge in other curricular contexts such as in a web-based context may be more flexible and applicable; hence, noticeably more students in this study expressed the conceptions of web-based learning as “applying” and “seeing in a new way”. Existing school curricula may have repeatedly imposed the image of school knowledge as remote, simply asking for absolutely correct answers. School curricula should be improved to make school knowledge more accessible and useful to students. Educators and curriculum developers need to explore some ways to help students shape more appropriate beliefs about school knowledge. Then, it is expected that students may develop higher-order conceptions of learning in the hierarchy revealed by the study, such as “applying”, “understanding” and “seeing in a new way”. This study also found that the students with different majors, genders and seniority tended to have statistically similar distribution among these conceptions of web-based learning.

This study is one of the early studies to elaborate students’ conceptions of learning, and particularly of web-based learning. This study also investigated how students’ conceptions of web-based learning might play a role in their approaches and expected learning outcomes in web-based learning environments. In general, the sophistication of conceptions toward web-based learning was found to be associated with better usages of searching strategies and higher self-efficacy toward web-based learning. Ellis and Calvo (2006) and Ellis et al. (2006, 2008) have made similar attempts in this area, and have shown some positive associations among conceptions of web-related learning, learning approaches and outcomes. These findings also strengthen the need for exploring students’ conceptions of web-based learning, as they are positively related to better ways and outcomes of web-based learning. Also, relevant research for investigating students of other grade levels, such as high school, may be of importance.
research can be undertaken to investigate students' conceptions of web-based learning in more detail, such as their conceptions of blended learning, or of online discussion or of online inquiry.

Moreover, previous research has suggested that students' conceptions of learning are related to their experiences (Marton et al., 1993; Marton et al., 1997). The follow-up interviews in this study also demonstrated the essence of learning experiences in the conceptions of learning and web-based learning. Goodyear et al. (2005) have indicated that how web-based learning is practiced is related to the students' feelings regarding the worth of their experiences. Future research should carefully investigate the role of relevant learning experiences in the development of conceptions of web-based learning.

Finally, this study attempted to use both "main" and "achieved" categories to depict each student's conceptions of (web-based) learning. In this way, researchers can not only know the general ideas expressed by the student (i.e., "main"), but also grasp his or her potential to attain the most sophisticated conceptions (i.e., "achieved"). This study hypothesizes that for students with the same category of "main" conception, those with a higher-order category of "achieved" conception may be more ready to reach higher-order conceptions of learning. Some longitudinal studies involving observations of the students are necessary to verify this hypothesis. Also, a categorization process that allows multiple allocations, perhaps with a proportionate evaluation, is preferable for future research.

Acknowledgment

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