Correlation of the summary method with learning styles

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Sarikcioglu L, Senol Y, Yildirim FB, Hizay A. Correlation of the summary method with learning styles. Adv Physiol Educ 35: 290–294, 2011; doi:10.1152/advan.00130.2010.—The summary is the last part of the lesson but one of the most important. We aimed to study the relationship between the preference of the summary method (video demonstration, question-answer, or brief review of slides) and learning styles. A total of 131 students were included in the present study. An inventory was prepared to understand the students’ learning styles, and a satisfaction questionnaire was provided to determine the summary method selection. The questionnaire and inventory were collected and analyzed. A comparison of the data revealed that the summary method with video demonstration received the highest score among all the methods tested. Additionally, there were no significant differences between learning styles and summary method with video demonstration. We suggest that such a summary method should be incorporated into neuroanatomy lessons. Since anatomy has a large amount of visual material, we think that it is ideally suited for this summary method.

The concept of learning style was raised regarding the hypothesis that each individual learns in a distinctive way. Many studies and various measurement tools to determine different learning styles have been conducted (10). The Kolb Learning Cycle, first introduced by David Kolb in 1984, is based on the principle of the learning cycle that all individuals use to acquire knowledge (9). Learning style is the process by which a person understands and retains information, thereby gaining knowledge or skills (9, 11). In the literature, a large number of measures of different learning styles have also been identified (19). The Kolb Learning Style Inventory (LSI) has been the most commonly used tool among medical students and professionals (3, 10, 19, 27, 28, 34, 35). The Kolb LSI is a questionnaire with 12 items in which respondents rank order 4 sentence endings that correspond to the four learning modes (12). An individual’s preferred learning style can be assessed by answering a relatively short survey, which asks the participant to rank certain statements about learning in the order that they apply to themselves. The LSI was designed to measure the degree to which individuals display one of the following four learning styles: diverger, assimilator, accommodator, and converger (19). Having information about the learning styles of students is essential for instructors since each learning style requires different educational materials at various levels of learning (10).

Kolb’s model has been criticized for not applying to all situations, for paying insufficient attention to the process of reflection, and taking little account of cultural-based learning differences and the relationship of learning processes to knowledge (9). Nevertheless, no model is perfect at present, and the Kolb model serves as a well-established model that allows comparisons of learning styles across medical specialties and between training levels. Its experiential basis is particularly relevant to the apprenticeship model of surgical training.

Recognition of these different learning styles within individuals and educational systems can improve the efficiency of learning (9). Understanding a student’s learning style is helpful in providing a successful learning experience, no matter what teaching method is used (4, 5, 25). Finalization of a neuroanatomy lesson with a video demonstration captured from anatomic models, a cadaver, or both has been used by our team for 4 yr. Initial feedback from students revealed that such a summary method was the students’ first choice as a new resource for learning (personal communications). Although such video-based materials have been used as a core of anatomy lessons (30), there is no article, to our knowledge, in the literature using such a summary method at the end of the lesson. For this reason, in the present study, we aimed to study the relationship between learning styles and summary methods used in neuroanatomy lessons and to evaluate student impressions on summarization methods.

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HUMAN ANATOMY LESSONS given to medical students are commonly delivered through lecture and practical classes and are generally designed for large group of students. It would appear that the traditional approach to teaching anatomy still prevails in many places, although a clear trend can be identified in the direction of offering descriptive anatomy in parallel with clinical anatomy. This involves exploiting the advantages offered by new technologies, mainly computer-aided learning. Anatomists who defend traditional anatomic methodology can be reluctant to make changes to their teaching and continue to present their instruction through a lecture-based approach alongside cadaver dissection. Computer-based technologies have been used by many anatomists to develop three-dimensional visualizations in their lessons (18). These are considered to be modernist anatomists, who are striving to use all the new techniques and resources available for teaching the subject (32).

Recently, major changes in educational strategies and practices have taken place. Some of these changes are learning styles, e-learning, faculty development programs, assessment methods, etc. The learning style of medical students has relevance for medical educators, medical administrators, and medical students themselves. A search of the relevant research produced no surprises; there were many articles on the learning styles of students. Additionally, there are many articles that describe how to integrate learning styles into course development or whether learning styles are a necessary component of course development (13).
Table 1. *Topics, hours, and summary methods used in the anatomy lessons*

<table>
<thead>
<tr>
<th>Topic of the Anatomy Lecture</th>
<th>Length of the Lecture, h</th>
<th>Summary Method Used</th>
<th>Days of the Lecture Session</th>
<th>Length of the Summary, min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limbic system</td>
<td>2</td>
<td>Video demonstration captured from cadaver specimens; question-answer</td>
<td>2</td>
<td>−8–9</td>
</tr>
<tr>
<td>Cranial nerves</td>
<td>5</td>
<td>Brief review of slides; question-answer</td>
<td>2</td>
<td>−12–14</td>
</tr>
<tr>
<td>The organ of sight</td>
<td>4</td>
<td>Video demonstration captured from anatomic models</td>
<td>2</td>
<td>−10</td>
</tr>
<tr>
<td>The organ of hearing</td>
<td>4</td>
<td>Video demonstration captured from anatomic models</td>
<td>2</td>
<td>−10</td>
</tr>
<tr>
<td>The common integument</td>
<td>2</td>
<td>Brief review of slides; question-answer</td>
<td>2</td>
<td>−7–8</td>
</tr>
<tr>
<td>Tracts of the spinal cord</td>
<td>2</td>
<td>Question-answer</td>
<td>1</td>
<td>−5–6</td>
</tr>
</tbody>
</table>

**METHODS**

**Students**

A total of 131 second-year medical students of Akdeniz University Faculty of Medicine (age: 19–20 yr, mean: 19.6 yr) were included in the present study. We administered Kolb’s LSI and a questionnaire for summary of the neuroanatomy lessons to 169 students total, but only 131 students completed both the questionnaire and LSI.

**Lessons**

A total of six neuroanatomy topics were delivered through lectures to second-year medical students in 19 h of instruction. All anatomy lessons were delivered by the same faculty member (L. Sarikcioglu). The topics, hours, and summary methods used in these lessons are shown in Table 1.

Due to our curriculum, some lectures were given in 2 days. Therefore, it appears in Table 1 that some lectures had more than one summary method. In fact, each lecture (given in 2 or 3 consecutive hours) had one summary method. For instance, “cranial nerve” lessons were given in 2 consecutive days. In 1 day, 2 h were spent, and a “brief review of slides” was used as the summary method. In the following day, 3 h were spent, and “question-answer” was used as the summary method.

**Preparation of the Summaries**

*Brief review of slides.* Some of the slides of the lecture were selected by a faculty member according to the aims and objectives of the lecture and then briefly shown and summarized.

*Question-answer.* According to the aims and objectives of the lecture, some questions were prepared by a faculty member and then asked to students to find the appropriate answers to the questions.

*Video.* Video film fragments were captured (with all rotation and magnification possibilities and including voice of a faculty member) in MPEG2 file format and then edited by the appropriate software. The final movie was rendered and saved in MPEG1 file format. Since the same faculty member narrated the video, there was no need for further explanation by the faculty member during streaming of the video.

**Data Gathering**

During the term, students have no information about the satisfaction questionnaire for neuroanatomy lesson and the Kolb LSI. After all lectures of the faculty member were finished, the questionnaires were delivered to the students.

**Satisfaction Questionnaire for the Neuroanatomy Lesson**

The satisfaction questionnaire was created by the authors to determine the satisfaction levels of students with the neuroanatomy lessons. The questionnaire was composed of five statements, and participants were asked to give a score for each instruction method on a five-item Likert-type scale (where 1 = absolutely not agree and 5 = absolutely agree) regarding the compatibility of each statement with the neuroanatomy lessons (Table 2).

**The Kolb LSI**

The Kolb LSI was developed by Kolb to determine the learning styles of individuals (10). The LSI was translated into Turkish by Askar and Akkoyunlu (2). The validity and reliability of the inventory were confirmed in a previous study (2) conducted among Turkish people. We found a Cronbach α-value of 0.89 for the Kolb LSI used in our study. Four learning modes were described in Kolb’s model: abstract conceptualization (thinking), concrete experience (feeling), active experimentation (doing), and reflective observation (watching).

The LSI includes 12 items completed by 4 different statements representative of 4 elements of the learning process. The inventory scores preferences for the four constructions on two Cartesian axes producing the dimensions of abstract conceptualization-reflective observation and abstract conceptualization-concrete experimentation. Preference scores are plotted on the two axes and fall within the quadrants, with each representing a learning style. These four learning modes are then translated into the following four learning styles: converger, assimilator, diverger, and accommodator. These ranks are summed, and the score at one pole of each domain is then subtracted from the score at the opposite pole, yielding a score for each domain ranging from −36 to +36 (19).

The four basic learning styles can be described as follows (20):

- **Diversers:** dominant learning abilities of feeling and watching. They have imagination, understand and are interested in people, recognize problems, and use brainstorming to solve them (10).
- **Assimilators:** dominant learning abilities of thinking and watching. They are interested in abstract concepts, use logic to define problems, and then create theoretical models for planning (10).
- **Convergers:** dominant learning abilities of thinking and doing. They define problems and use deductive reasoning to solve prob-

Table 2. *Satisfaction questionnaire for the neuroanatomy lessons*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>I attended the neuroanatomy lessons</td>
<td>1</td>
</tr>
<tr>
<td>The neuroanatomy lessons covered the lesson’s aim and objectives</td>
<td>1</td>
</tr>
<tr>
<td>The brief review of the slides contribute to my learning</td>
<td>1</td>
</tr>
<tr>
<td>The question-answer session contributed to my learning</td>
<td>1</td>
</tr>
<tr>
<td>The video demonstration contributed to my learning</td>
<td>1</td>
</tr>
</tbody>
</table>

Statements were scored with a five-point Likert-type scale, where 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, and 5 = strongly agree.
How We Teach

SUMMARY METHODS AND LEARNING STYLES

Table 3. Student scores to the statement “The summary covered the lesson’s aim and objectives”

<table>
<thead>
<tr>
<th>Score</th>
<th>Accommodator</th>
<th>Diverger</th>
<th>Converger</th>
<th>Assimilator</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of students</td>
<td>%</td>
<td>Number of students</td>
<td>%</td>
<td>Number of students</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>1/10</td>
<td>10</td>
<td>2/39</td>
<td>5.9</td>
<td>2/39</td>
</tr>
<tr>
<td>4</td>
<td>2/10</td>
<td>20</td>
<td>3/9</td>
<td>33.3</td>
<td>17/39</td>
</tr>
<tr>
<td>5</td>
<td>7/10</td>
<td>70</td>
<td>4/9</td>
<td>44.4</td>
<td>8/39</td>
</tr>
</tbody>
</table>

The statement was scored with a five-point Likert-type scale, where 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, and 5 = strongly agree. Differences between every pair of learning styles were not significant.

DISCUSSION

Our study revealed that summarization of the lesson by video demonstration was the most accepted or preferred summary method in the neuroanatomy lessons, although we had students with different learning styles. Analysis of the data showed that learning style did not correlate with the summary method of video demonstration. In other words, it was accepted by students belonging to each of the four learning styles. Therefore, we think that the summary method of video demonstration should be widely used by anatomists or medical students; 131 of 169 students returned the completed questionnaire and inventory. Thirty-eight student questionnaires were excluded from the study due to inappropriate filling (giving the lowest or highest mark for all questions in the questionnaire for neuroanatomy lessons or filling all blank areas of the Kolb LSI). Due to the aforementioned reasons, there was no opportunity to determine the students’ learning style or their selection of summary method. This attitude was considered as unwillingness to participate in the study.

Among the four learning styles, 10 students were accommodators, 9 students were divers, 34 students were convergers, and 78 students were assimilators. Data from the questionnaire are shown in Tables 3 and 4.

A comparison of summary methods with low scores (1–3) and high scores (4 and 5) in each learning style revealed that there was a significant difference (P < 0.05) between every pair of methods except for the pairs of “question-answer” and “brief review of slides” in accommodor and converger learning styles. There was no correlation of the results with age or sex of the students.

Table 4. Numbers of students in the two main score groups in relation to the summary method and learning style

<table>
<thead>
<tr>
<th>Video demonstration</th>
<th>Accommodator</th>
<th>Diverger</th>
<th>Converger</th>
<th>Assimilator</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of students</td>
<td>%</td>
<td>Number of students</td>
<td>%</td>
<td>Number of students</td>
</tr>
<tr>
<td>Low score</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>High score</td>
<td>10/10</td>
<td>100</td>
<td>9/9</td>
<td>100</td>
<td>31/34</td>
</tr>
<tr>
<td>Question-answer</td>
<td>6/10</td>
<td>60</td>
<td>6/9</td>
<td>66.7</td>
<td>10/34</td>
</tr>
<tr>
<td>High score</td>
<td>4/10</td>
<td>40</td>
<td>3/9</td>
<td>33.3</td>
<td>24/34</td>
</tr>
<tr>
<td>Brief review of slides</td>
<td>5/10</td>
<td>50</td>
<td>5/9</td>
<td>55.6</td>
<td>24/34</td>
</tr>
</tbody>
</table>

Scores of 1–3 were considered as low and 4 or 5 as high. Differences between every pair of learning styles were not significant except for the pair of diverger-converger in the “question-answer” summary method.
teachers in other disciplines. Apart from the advantages of video demonstration, the greatest difficulty in this method is the capturing of the video. Subsequently, the video needs rendering and saving in an appropriate file system.

It is necessary for a teacher to be highly knowledgeable in his/her discipline. However, it is perhaps more important to show enthusiasm and interest in teaching that discipline. Moreover, good teachers are always thinking about ways to improve what and how students learn (23). If the teaching strategy is matched to the same type of learning style, the student will learn more quickly and retain the information longer (26). Based on feedback from the students (personal communications), our previous experiences have shown that students like the usage of computer technology in anatomy lessons and like to watch and listen to the lesson from a video projection. The data of the present study confirm our previous experiences. The order of the summary method choice of the students was video demonstration, question-answer, and brief review of slides. We think that the reason why students like video is that they see and hear how and/or where they will use the knowledge that the lecturer tried to teach.

In the present study, we also tried to clarify if the summary covers the lesson objectives. Student’s answers to these questions were very satisfactory. This means that summary is greatly taken into consideration by students. Additionally, brief summaries before a new learning objective of the lesson is started were generally accepted by students (unpublished observations). Therefore, summary, the last but one of the important parts of the lesson, should be carefully taken into account and prepared according to student’s learning styles and expectations.

The teaching of anatomy consisted of explanations to the students in theoretical class lectures and of study of the human body through dissection and osteology practices. Students thus learned anatomy from these explanations and from diverse anatomy books but were given little opportunity to participate (beyond engagement with practical sessions) and, in general, could be considered as passive onlookers (15, 32). This study revealed that students select the learning strategy that matches their learning style if this option is provided. Therefore, this option should arouse students’ curiosity and should motivate and encourage them to learn.

To assist understanding and facilitate the incorporation of experiential learning into the curriculum, Dale (8) developed a pictorial representation called the “cone of experience.” The objective of the model is to provide a visual analogy to the type of experiences that influence the learning process. Dale’s cone of experience is a model that has at its bottom direct experiences and at its top the abstract, symbolic treatment of experience. According to Dale’s studies, the top of the cone involves learning from information presented through verbal symbols and is the least effective method. Active learning involves input from multiple sources through multiple senses (hearing, seeing, feeling, etc.). Dale believed that learners benefit from abstract instructional activities once they have concrete experiences to give meaning to them. The bottom three items (discussion group, practice by doing, and teaching others) are participatory (active) learning methods. In contrast, the first four items (lecture, reading, audiovisual, and demonstration) are passive learning methods. For instance, individu-
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