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Organising Pedagogical Activities for Sleep

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ABSTRACT

The aim of this study is to highlight the importance of sleep in the memory-learning procedure, through pedagogical activities. For this purpose: (a) there was investigated the relationship between sleep and memory–learning through contemporary research data from the Neuroscience and (b) pedagogical activities were designed and proposed. Recent studies support that sleep is affecting the daily activities, the physical and mental health and it plays a significant role in memory's consolidation and furthermore in learning. Research data support that the problem sleep lack is fundamental in adolescence. Taking into consideration that: The recent findings of the positive role of a sufficient and qualitative sleep in memory–learning are not widely known in pupils / students. The learning process concerns directly pupils / students as it is related to their personal progress and prosperity. We thought that it would be meaningful to accomplish this work and more specifically: (a) to accomplish a didactic transformation of data from the field of Neuroscience related to sleep and memory - learning. (b) to propose specific examples such as activities of a role playing, synthesis of a questionnaire and several dramatizations.

Keywords: sleep, memory, learning, storytelling.

INTRODUCTION

Today, it is generally accepted that a normal – qualitative (good) sleep has an important influence in human labour, mental and psychological development and equilibrium. Qualitative sleep is considered as a continuous, sufficient (7 – 9 hours) early at night sleep [28, 41]. Sleep deprivation or excess is problematic [17, 18, 24]. Sleep is divided into NREM and REM phases [45] and it follows the circadian rhythms [16, 46].

The relationship between sleep and memory – learning is an interesting, provocative and modern issue which concerns all of us. The findings which sustain this relationship, are only recently accumulated over the last ten years. It is certified from these data that:
Sleep attributes greatly to the main cognitive tasks such as attention, concentration, alertness, encoding and consolidation of memory and finally problem solving-decision making. But the strongest experimental evidence supports a primary role for sleep in the regulation of neuroplasticity [20, 47, 49].

Even short periods of full sleep deprivation could have a permanent ramification impact to memory – learning [17, 18, 24]. The sleep demand in pupils / students is more intense due to learning needs. Every day at school, children learn many, new themes and their brains have to reform and record them. Research certifies that pupils / students will have a better learning only if they sleep after the early obtained knowledge [15, 50]. For this reason, [13] introduce a

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good night sleep to pupils/students before taking exams the next day so that they will assimilate the yesterday reading.

Taking into consideration the followings:

1. The relationship between sleep and memory – learning which is a major and vital issue, especially for pupils / students who are in an active learning procedure
2. The present didactic approach is designed and organized appropriately and it is addressed to pupils / students who are not specialized to Neuroscience, Biology and Medicine in general
3. Sleep's functions and the procedures of storage and information recall (memory and learning) are very complicated which involved many and complex concepts
4. Sleep's major contribution to memory - learning, is sustained only the last ten years. The neuroscience research data are discarded into various, specialized sources, they are not widely broadcasted to pupils / students who will be the future citizens. Consequently, these data are not processed, are not familiar and ignored to pupils / students
5. Nonetheless, these findings would alter the conceptions and attitudes of a major part of pupil / student population. They might suffer from insomnia or they are used to stay out late by surfing the internet, either ignoring the negative consequences sleep lack or they believe that by adopting vigil they become adults.

For all the above reasons, it was determined to accomplish the present study which aspires to highlight the importance of sleep in memory – learning procedure, through pedagogical activities.

In order to accomplish this study, it was required the followings:

a. It was investigated the relationship between sleep and memory – learning through neuroscience research data and
b. It was designed and proposed pedagogical activities.
c. This didactic approach would gradually contribute to form a positive attitude and behaviour in pupils / students.

THE CONCEPTUAL FRAMEWORK

Definitions – basic acceptances

Memory – Learning - Neuroplasticity

Memory constitutes a fundamental property of the brain and its storage is an inextricable part of the procedure of continuous information processing from the brain. Brain areas involved in the neuroanatomy of memory such as the hippocampus, the amygdala, the striatum or the mammillary bodies are thought to be involved in specific types of memory [30].

Memory is based into the alterations of synaptic communication among neurons. These alterations are maintained for short or long period of time. This ability to alter the synaptic communications is called neuroplasticity which is the base of memory and learning [31].

Nowadays, it is believed that brain is not a physiologically static organ, and it explores how - and in which ways - the brain changes throughout life [39]. Ramon y Cajal in 1890, introduced the principle of connective specificity among neurons and he stated that pre-existing connections can be either reinforced in action or multiply the terminals in use. Kandel vindicated Cajal through experiments on aplysia [25].

Nowadays, it is believed that neurons communicate by applying the Hebb rule, cells which fire together, wire together [26]. Especially, Eric Kandel in 2009 found that the cellular basis for memory depends on persistent changes in synapses. The differences in the strength of these connections come about through learning. Neuroplasticity occurs from cellular changes due to learning, to large-scale changes involved in *cortical remapping* in response to injury.

Memory is distinguished into two categories, short-term memory and long-term memory according to the fingerprint time of an information – knowledge in the brain [5].

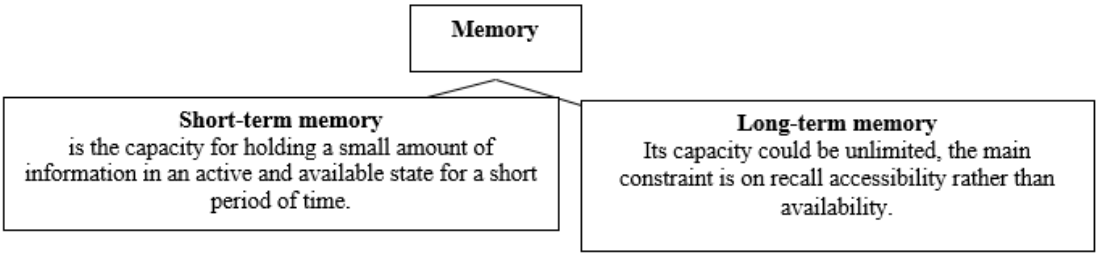


Figure-1. Short-term and long-term memory.

Furthermore, long-term memory is usually divided into two types, explicit and implicit memory whether the subject has or has not consciousness of what he is learning [7, 27].

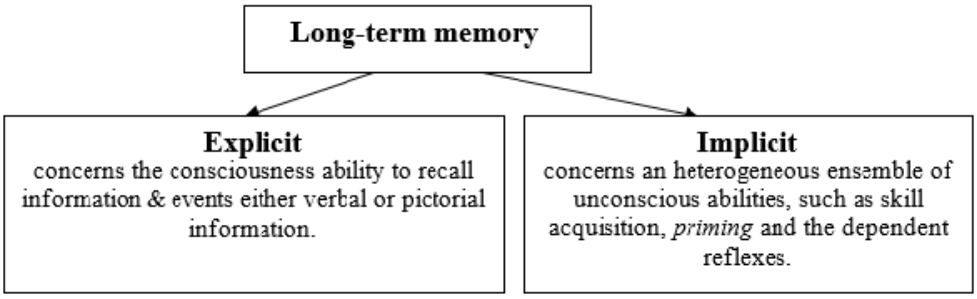


Figure-2 Definitions of explicit and implicit memory

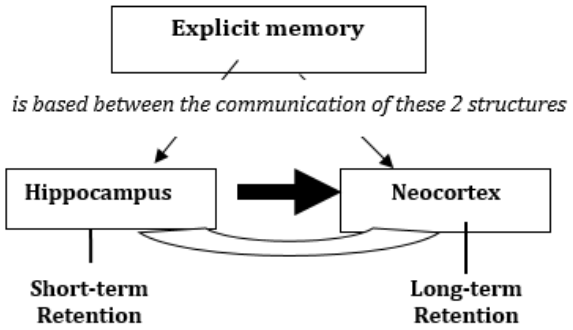


Figure-3. Location of long – term memory [15, 47].

Learning is acquiring new or modifying knowledge, behaviours or skills. Learning builds upon and is shaped by what we already know so that learning is considered as a process. Learning produces changes in the brain which are relatively permanent [43].

Sleep

Sleep is a naturally recurring state characterized by absent consciousness, relatively suspended sensory activity, and inactivity of all voluntary muscles [32] (p. 936)). It is part of an endogenous biological cycle of sleep and alertness following the circadian rhythms. Finally,

it occupies one third of our lives. In mammals sleep is divided into two broad types: sleep with NREM and sleep with REM. Each type has a distinct set of associated physiological and neurological features [45]. NREM sleep was divided into three stages in 2007 by the American Academy of Sleep Medicine (AASM).

Stage 1 occurs in the beginning of sleep with slow eye movements. It is considered the gate between awake and sleepy.
Stage 2 no eye movement occurs and dreaming is very rare. It consists of 50% of the whole eight hour night sleep.
Stage 3 is a deep sleep which is also called Slow-Wave Sleep (SWS). Dreaming is more common in this stage than in other stages of NREM sleep [44].
Stage 4 – (REM sleep), most muscles are paralysed. REM sleep appears to be important for brain development so that it occupies the majority of infants' sleep time [10]. Furthermore, it helps in the emotional processing of prominent events which occur during the day and finally brain adapts according to new situations.

The relationship between Sleep and Memory - Learning
Recent studies [12, 14, 48] have shed light on the role of sleep in neuroplasticity and more specifically in memory consolidation and optimization of neural networks to retain eminent memory traces.

Memory consolidation:
Human brain consists of neural networks which are involved in both the encoding and the consolidation of memory and during sleep no new incoming information is loaded so that memory consolidation works more effectively during sleep [14].

After encoding, memory contents initially remain labile and vulnerable [3] and they need to undergo a phase of stabilization in order to be remembered in the long-term [19]. Such stabilization is referred to as memory consolidation. Thereby, making the loss of consciousness an adaptive feature of sleep which benefits the stabilization of recently encoded information [8]. Moreover, an important mechanism proposed for sleep's role in the facilitation of memory consolidation is the replay of memory traces in hippocampal and neural networks during sleep [14, 38].

What does sleep attribute?
Sleep attributes greatly to the main cognitive tasks such as attention, concentration, alertness, encoding and consolidation of memory and finally problem solving-decision making.

- ***Attention***: good sleep reinforces attention [22, 40] which is the most important cognitive function.
- ***Alertness***: is reduced after sleep deprivation and it is observed reduced brain activity especially in thalamus and prefrontal cortex [47].
- ***Memory solidification***: is the ability of remembering and solidifying recently obtained memory. Researchers certified that sleep after memorization and before the memory test, it improves the performance. Thereby, sleep has an active role in organization and solidification of memories [14, 48].
- ***Problem solving and decision making***: is sharpened after a good night sleep. Research proved that humans' brain who stayed awake the whole night, were oscillated from absolute euphoria to absolute despair [20]. This fact is not the best in order to reach a right decision.

DIDACTIC TRANSFORMATION

The present didactic approach is designed and organized in such a way so that it would address to the young population and more specifically to pupils of High school and students who are not specialized to Neuroscience, or Biology or Medicine in general.

In order to didactically transform this scientific material so that it would become suitable for teaching into pupils/students, it is necessary to go through from scientific Knowledge to school Knowledge and to proceed to the followings:

(i) To locate the basic concepts – ideas which they will be approached
(ii) To determine the basic objectives which will be set
(iii) To investigate, to locate, to select and probably transform the relative scientific material
(iv) To investigate and to select the appropriate didactic methods, tools and techniques
(v) To design the appropriate pedagogical activities.

Basic ideas

- During sleep, various brain parts are activated and sleep follows the circadian rhythms
- Sleep is consisted of two phases, Non Rapid Eye Movements (NREM) and Rapid Eye Movements (REM)
- The concept of equilibrium at sleep. Human organism needs the appropriate amount of sleep. Deprivation or excess of sleep is problematic
- The concepts of memory and learning
- The relationship between sleep and memory - learning
- The qualitative sleep is sufficient, constant and starts early at night

Qualitative sleep:

- Promotes memory and learning facilitates the neuroplasticity and the communication among different brain areas
- Enhances the attention which is the base of all cognitive abilities
- Enhances alertness
- Improves the ability to remember and solidification of recently obtained memory
- Sharpens the ability of problem solving and decision making.

General objectives

In this study, we solicit to set objectives of different areas (emotional, mental and action ones) which angle to construct a gradually global - complex thought [33, 34] so that pupils/students will adopt positive attitudes towards a qualitative sleep.

Indicative objectives

Pupils/Students:

- To investigate the beneficial effects of qualitative sleep mainly in memory and learning
- To comprehend/evaluate that their organism needs a specific amount of sleep: deprivation or excess is problematic
- To appreciate the complexity of human organism functions
- To adopt positive views and attitudes towards qualitative night sleep
- To develop collaborative and ccommunicative skills
- To argue and document their viewpoint [6].
- To design and suggest optimistic prospects - solutions to possible problems towards sleep.

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Investigation and Selection of the appropriate educational material

For this study, it is required the investigation and selection of the appropriate educational material. We can exploit a great variety of educational material types several sources such as the internet, libraries, newspapers, journals and scientific meetings.

This educational material is used directly or appropriately transformed in order to cater pupils/students' needs. It can be given to pupils/students as a simple text or an enriched text with various figures and images or even a more popular Power Point.

Didactic methods - techniques and Activities

In this study, we aspire to create a rich and active learning/didactic environment [37] combining different methods which accomplish educational objectives of different areas. Methods and activities are selected according to the following criteria:

- To be active and to rear pupils/students' interest
- To operate for stimulating cooperation and as incentives for participation [35]
- To develop pupils/students' critical thinking
- To integrate dramatizations and conflict situations (role playing, dramatized dialogues) which motivate pupils/students' emotions and interests and foster their participation [42].

These activities can be based on a variety of teaching methods and approaches such as Jigsaw method, role playing, synthesis of questionnaire, storytelling [1, 2, 21, 23, 35, 36].

DESIGN AND ORGANISATION OF ACTIVITIES AND EXAMPLES FOR SLEEP AND ITS IMPORTANCE INTO MEMORY – LEARNING

Design and Organization of Activities

In order to design and organize the activities, it was necessary to determine and relate the (a) Conceptual framework–Key ideas, (b) the Educational Objectives and (c) the Activities, (see table 1).

Table 1: Design of Activities for sleep and its importance into memory –learning

Conceptual framework–Key ideas	Indicative Objectives	Activities
The qualitative sleep: ➢ Facilitates neuroplasticity ➢ Enhances memory – learning ➢ Reinforces attention ➢ Reinforces alertness ➢ Improves the ability of memory and solidification of recently obtained memory ➢ Sharpens the ability of problem solving and decision making	Pupils/Students: ➢ Gradually adopt a positive attitudes towards qualitative sleep ➢ To comprehend that sleep is a very important function which follows the circadian rhythms. ➢ To develop social skills (collaboration and communication) ➢ To argue and document their viewpoint	**Activity (1)** Jigsaw Role Playing *He considers night for day* **Activity (4)** Synthesis of questionnaire *Sleep and its importance* **Activity (5)** Synthesis of open letter to a young friend *Why should I go early to bed tonight?*

Our organism needs a specific amount of sleep: deprivation or excess is problematic Pythagoras: *Food, drink, sleep and sex, all these should be in moderation. Immoderation causes disease* Alcmaeon: Equality - Equilibrium Hippocrates: *Both of them, sleepiness and insomnia are harmful* Walter Cannon: Homeostasis	Pupils/Students: ➢ To investigate and compare the dominated conceptions for sleep and its importance through years. ➢ To develop listening skills and show respect for the viewpoint of others ➢ To develop an exploratory & critical attitude towards the dominant, social perceptions for sleep and its importance.	Jigsaw Role-Playing Activity (2) An intense televised debate about *Insomnia and Sleepiness*
Sleep unfolds into 2 phases while important functions take place During REM sleep, hippocampus and amygdala are activated and it occurs the consolidation of emotional memories Morfeas, in ancient years, was considered the god of dreams.	Pupils/Students: ➢ To develop analogical and symbolic thinking through approaching myths ➢ To cultivate their imagination ➢ To practice in the synthesis of stories	Storytelling activity (3) Synthesis of a story *Morfeas's journey from NREM to REM sleep and vice versa.*

It should be clarified that the above mentioned example of the design and organization of activities for sleep and its relation to memory - learning is an indicative proposal. Only part of the above activities it has been applied into a student class. To investigate the effect of all of the proposed activities on students' knowledge and attitudes specific field research is needed using a real classroom.

Pedagogical techniques for Activities and Examples

Jigsaw Role Playing Activity

The Jigsaw Role Playing Activity derives from the combination of Jigsaw method [4] and Role Playing [11] and it can support both cooperative - collaborative learning and Role Playing. The main goal of this activity is to encourage pupils/students to learn through performing specific investigations and engaging roles.

The proposed Jigsaw Role Playing Activity consists of the following seven phases:

(i) ***Introduction to the activity****:* Pupils/Students are informed about the whole context of the activity, exchange ideas and clarify the aims and the whole procedure of the activity.
(ii) ***Original group creation****:* The pupils/students are randomly assigned - using the Grouping tool - to 4 groups of 6 students. Initially, each group discusses the issues, striving to form a commonly acceptable framework of ideas. Each member of each group should also decide which essential issue they prefer to investigate.
(iii) ***Creation of expert groups****:* Each expert group must visit the specific areas to collect specific data, attempt as much as possible to comprehend the deeper meaning of the data they have collected, include a variety of learning representations: e.g., photographs, texts, schemes,

and organize an educational material as a learning tool to teach their colleagues in their base groups.
(iv) ***Back to the original groups****:* On returning to their original group, each expert should propose their learning materials.
(v) ***Group Role playing formation/construction****:* Each group has to prepare a whole learning material as part of a role game in order to cover the total knowledge acquired during their learning process, taking into account all the information included in the instructional materials created by the expert groups.
(*vi)* ***Group Role playing presentation****:* The presentation of the *Role play* by the pupils/students.
(vii) ***Assessment-Evaluation****:* Indicative criteria on the basis of which the role play of pupils/students can be assessed are, among others, as follows:
if each specific role play:
(a) Integrates successfully dramatizations and conflict situations to motivate students' emotions and interest,
(b) is able to excite pupils' fantasy and interest [29].

Example (a): Jigsaw Role Playing Activity (1) (see table 1)
He considers night for day. How are we going to convince him to sleep at nights?

A short scenario: *A family discussion about sleep*
Stelios, first year student in a district University, returns home for his summer vacations. Meanwhile, his parents realised that *he considers night for day.* He does not sleep at all during night but he sleeps during daytime and he wakes up in the evening. His parents are worried but they do not know the appropriate arguments of a good night sleep.
Organise a family conversation based on arguments of a good night sleep in order to convince Stelios to sleep early at night.

Create Four Expert Groups for specific investigations into the following essential issues:

- Circadian rhythms (word etymology).
- Positive consequences of night sleep (Structure 2-3 arguments from contemporary Neuroscience research)
- Negative consequences of lack of night sleep (Structure 2-3 arguments from contemporary Neuroscience research)
- The importance of night sleep in greek tradition (Dominant social conceptions, sayings, proverbs, mottos in favor of a qualitative night sleep).

Roles
Role 1: Stelios (Student)
Role 2 & 3: Grandmother and Grandfather of Stelios
Role 3 & 4: Mother and Father of Stelios
Role 5: Neighbor (favorite friend of Stelios) who studies Neuroscience.

Example (b): Jigsaw Role Playing Activity (2) (see table 1)
Both of them, sleep and lack of sleep when they are excessive, they are harmful. An intense televised debate on the theme: Insomnia and Sleepiness, two sides of the same coin. From Pythagoras and Hippocrates until the contemporary ideas of Neuroscientists. Create Four Expert Groups for specific investigations into the following essential issues:

(i) The equilibrium in sleep through the greek tradition, the greek and foreign literature (sayings, proverbs, dominant social perceptions, mottos concerning insomnia and sleepiness).

(ii) The equilibrium in sleep in ancient greek philosophy (Pythagoras, Hippocrates, Alcmaeon)
(iii) Contemporary views from Neuroscience for insomnia
(iv) Contemporary views from Neuroscience for sleepiness.

Roles:
Role 1: Philosopher
Role 2, 3, 4: Neuroscientists
Role 5, 6, 7, 8, 9: Pupils/Students
Role 10: Coordinator.

It is clarified that the number of participants in the discussion of Neuroscientists, Philosophers and pupils/students is modified according to circumstances.

Example (c): Storytelling Activity (3)
Synthesis of a story based on supporting material and key questions - Telling the story (group work).

Morfeas's journey through NREM to REM sleep and vice versa.
According to ancient Greeks, Morfeas was the god of dreams and his mission was to appear in human's dreams impersonating several faces.
He had three brothers, called the Dreams, who helped him. Their names were Fovitor, Fantasos and Ikaelos.
Imagine and describe a fiction Morfeas's journey into NREM and REM sleep.

You can rely your story, of Morfeas and his brothers' fantastic night visit during your sleep, after having experienced an emotional fact.

You could rely on the supporting material relevant to the following themes:
- The dream in ancient Greece (according to Hippocrates, Platon and Artemidoro)
- Gods of sleep in ancient Greece (God of sleep, Morfeas, Pasithei)
- NREM and REM sleep
- Sleep and emotional memory - Sleep and explicit memory.

Source: http://hypnos.gr/index.php?mod=text&view=_text_page_142&pid=142&cat=133
http://en.wikipedia.org/wiki/Sleep
http://www.youtube.com/watch?v=5iV0ThBmXmA&feature=youtu.be

Indicative key questions
- What would Morfeas see as he was going through NREM to REM sleep and vice versa?
- Which possible facts and memories will wake up Morfeas in a specific person?
- Whose of Morfeas brothers will accompanied him to this journey?

Example (d): Synthesis of Questionnaire (Activity 4) (see table 1)
Sleep and its importance.
Pupils/Students construct a questionnaire in group work and then in the class. Every pupil/student has the responsibility to address it to five persons (friends, relatives, classmates) (see questionnaire in appendix).

Example (e): Synthesis of an open letter to a young friend (Activity 5)
(friend, relative, classmate) (see table 1)
Why should I go early to sleep?
Which arguments will I use in order to sustain the importance of qualitative sleep and to convince a young friend to change his habits to stay up late and to aspire a qualitative sleep.

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Instructions

a) Entrench your arguments in scientific studies.

b) Use cartoons, sayings, mottos and proverbs so that you accomplish to have an interesting and convincing letter.

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http://www.youtube.com/watch?v=5iV0ThBmXmA&feature=youtu.be

APPENDIX

QUESTIONNAIRE FOR YOUR SLEEP
SLEEP AND ITS SIGNIFICANCE

1. Age:
18-25 □
25-30 □
30-35 □

2. Occupation:
Student □
Employee □

3. If you are an employee, which is your field of work?
……

4. How many hours do you sleep during the 24h day-night?
……..

4a. Do you have siesta?
Yes □
No □
I don't answer □

4b. Justify your answer, by giving two reasons for whom you are used to have or not have siesta
……
……
……..

5. At night, what time do you usually go to bed?
……..

6. Mark with an X in one or more of the following sentences which you agree

During night sleep, usually:
- I do not have difficulties to sleep □
- I sleep quietly □
- I sleep constantly without awakenings □
- I find it difficult to get to sleep □
- During the night, I wake 3-4 times □
- I wake early in the morning and then I can't sleep □
- I can't wake in the morning □

7. How many times during the week or month do you stay awake? (meaning that you sleep after 2-3 am)?
……

8. Do you stay awake for a specific reason ?

……

9. Mark with an X one or more of the following sentences which you agree

When I stay awake,
- I regret because I find it difficult to wake up the next morning □
- I regret because I do not feel well the whole next day and literally, its like *doing nothing the whole day* □
- I don't regret because I feel very well the next day □
- I don't regret because I feel that I've grown up and I am free to choose whether I want to stay awake the whole night or not □
- I don't regret because I manage to compensate the remaining sleep during the day □

10. Mark with an X one or more of the following sentences which you agree

I've noticed that when I stay awake at night, I experience usually the next day:

a. Difficulties to concentrate eg. in order to study a scientific topic or to finish tasks which require attention eg. in order to fix a complicated device □

b. I experience difficulties in order to accomplish tasks which demand increased alertness (quick and accurate responses on my behalf) □

c. I experience difficulties in order to make the right decisions (decision making) on crucial matters which I'm concerned □

d. I experience difficulties in order to remember e.g. details on various matters which took place the previous day □

11. Mark with an X one or more of the following sentences which you agree

During exams (now and in the past), I ascribe better (remember, learn the syllabus):

a. I study the syllabus and I take the exams after an 8h sleep during the night □

b. I study the syllabus and I take the exams after a few hours and interrupted night sleep □

c. I study the syllabus and I take the exams without sleeping at all (no night sleep) □

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