ИСПОЛЬЗОВАНИЕ КАРТОЧЕК ДЛЯ ЗАПОМИНАНИЯ ПРОФЕССИОНАЛЬНОЙ ТЕРМИНОЛОГИИ В СИЛОВОЙ ЭЛЕКТРОНИКЕ

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USING CARDS FOR MEMORIZING PROFESSIONAL TERMINOLOGY IN POWER ELECTRONICS

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Annotation. *The paper deals with an approach that allows to retain professional terminology in such a versatile branch of science and technology as Power Electronics. This topic is especially relevant for designing such courses as Professional English, Power Electronics for the students major in Electrical Engineering. We consider topic-related handbooks, textbooks and tutorials as the sources of the professional terms. According to the approach the phrases with the terms are written on small carton cards. On one side of a card a learner writes the expression in English while on the other side – in Russian. We accepted Russian as a mother tongue in this paper. Learning 20–30 essential phrases per day is proposed as sufficient. We use Ebbinghaus's forgetting curve to schedule the intervals of repeating the terminology during the day so as to provide their effective retaining. We also scale our approach to the weeks and months. To support our technique efficient methods to use the phrases are supplemented. It is emphasized that using the approach under development is necessary to build a solid knowledge ground for future career in the field of Power Electronics. Consequently, we presume that introducing the approach into courses for the Bachelor Degree Program 'Electrical Engineering' the fruitful outcomes of the extensive research on memory by Hermann Ebbinghaus*

Nowadays Power Electronics is the cutting-edge technology that shapes our present and future. It is about how to get all the devices and gadges working both at our homes and institutions where we work. Therefore, electronic devices surround us almost everywhere. That's why we are urging to get acquainted with this amazing area of interest. Moreover, as teachers we provide a Bachelor Degree Programme 'Electrical Engineering' at Tomsk Polytechnic University. Consequently, we need to render a high quality content to our students so as to provide the corresponding standard of education. An analysis of modern handbooks, textbooks and tutorials revealed that over 80% of up-to-date topics in Power Electronics are covered in the English language. An extensive body of research was provided in "Power Electronics Handbook" [1], where a number of researchers and educators presented their chapters both on classical theory and breakthrough technologies that are present in Power Electronics nowadays. Therefore, we took this handbook as a basis for acquiring the terminology that the authors use to convey us their knowledge. The examples of essential terms and phrases in Power Electronics are as follows: a control voltage signal; a freewheeling path for the load; before the diode starts reverse conduction; electrons destined to be injected; electrons in P region and holes in N region; etc. We note that the approach under development is suitable either for students and for teachers as well as for any interested individual who wants to get into such a broad area of study as Power Electronic. Although, upon starting to read this book [1] there exists a high probability that the level of

comprehension will be very low at first. And here is the point when the approach of fixed expressions memorizing comes to its act to boost understanding the topic of interest.

The approach stems from the research of German psychologist Hermann Ebbinghaus who pioneered the experimental study of memory [2]. Ebbinghaus is known for revealing the forgetting curve and the spacing effect that represent the laws of effective learning. Therefore, to memorize something we should use the approach that implies the properly spaced repetition of the information that we want to memorize. The spacing effect demonstrates that learning is more effective when study sessions are properly spaced out. Among Russian educators that use this technique we can outline Edgar Kulikov whose online English Language School is amidst the most effective for Russian natives.

First, we need to sort out a chunk of material that is to be profoundly comprehended and memorize the terminology. For this purpose, we strongly recommend to pick a few passages containing not more than 7…10 lines each of topic-related text on a daily basis. Then we sort out the stable expressions and write them out on small carton cards. Their number should range from 20 to 30. On the one side of a card we write a fixed expression in our mother tongue and on the other one we put that same phrase in the language that we learn. The key moment is we always start repeating from the phrase in our mother tongue at first. This is because when speaking to someone whose mother tongue is e.g. English one tries to translate their thoughts from Russian into English and finally read them to ourselves in English, not visa-versa.

Thus, we produce the cards on a certain topic with both Russian and English terms and phrases on the corresponding sides. Then we repeat those expressions to ourselves with certain time intervals. At times, we should also read the expressions aloud to strengthen our retention process and make better our pronunciation.

Our long practice shows that an optimal interval between repetitions is 1 hour. Consequently, we all have at least 16 hours per day to repeat the expressions each hour. In this case around 2 minutes per hour are only needed for the process of repeating. Surely, that will not affect our primary duties at work.

Note that the optimal number of the expressions that to be memorized per day is from 20 to 30. Using less lexical units does not give an optimal load for the brain while using more of them leads to dissipated attention.

In Figure 1 we render the approximate Ebbinghaus's forgetting curve for the approach under study.

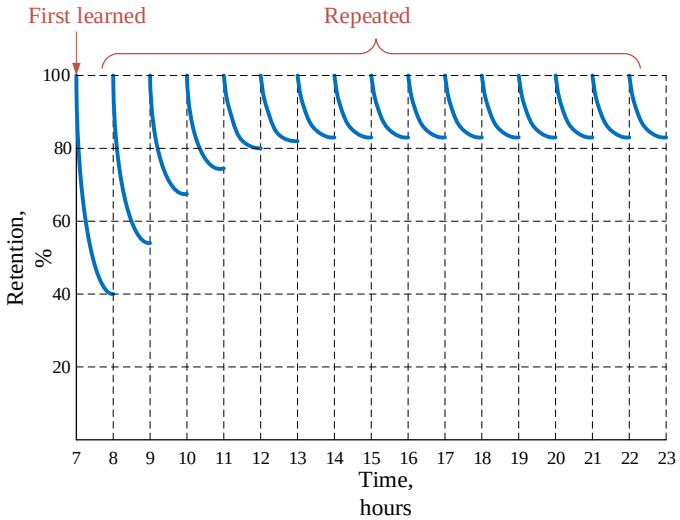

Fig. 1. Ebbinghaus's forgetting curve for memorizing professional terminology during the day

Abscissa axis corresponds to the time during the day. The moments 7, 8,…22 initiate the time intervals when we repeat the phrases written on the cards. Whereas the axis of ordinates shows the level of retention. Here we admit that the latter variable is hard to measure. Moreover, it refers to so-called 'latent' variables [3] that we cannot measure but are able to render an approximate value of the variable.

So, after first learning the expressions at 7:00 am (Figure 1) we surely forget 60% of the information in an hour (from 7 to 8 am). Note that the process of forgetting obeys the exponential law. At first, the rate of forgetting is approximately 60% per hour. Then after repeating the phrases at 8 am the rate of forgetting is approximately ¾ of that within the previous interval. Generally, after about 5 hours of such practice the retention of the information occurs in a stable manner and the rate of forgetting will be reduced significantly to approximately 18% per hour. Obviously, after some repetitions each hour one is capable of retaining 80% of topic-related terminology. Therefore, at the end of the day the learner can more or less use the phrases in the topic of interest quite confidently. Then comes the time to have a rest after the last reading the phrases at 22 pm. Next morning the person should just refresh their memory by repeating the words learned the previous day only one time. After that, the process described in this passage is repeated for the following day as well as for the weekdays left.

On the weekends, we need to refresh all the expressions learned during the weekdays. We recommend that the student only look through all the phrases learned during the week (approximately 100) for 3 times on Saturday and for 3 times on Sunday. Each repetition on the weekends consumes not more than 10 minutes.

One more issue of using the proposed approach is that on the last day of each month we repeat all the phrases we retained during the month one time. This process lasts not longer than 40 minutes. Then all starts again.

Although, the method described above is necessary to retain the professional expressions, it is not sufficient to feel comfortable in any topic-related situation. That is why the approach implying making cards with the terminology should be supplemented by other techniques that boost learner's involvement in topic and language environment, e.g. connecting expression in one meaningful phrase; watching topic-related videos; using visual dictionaries like [4] to describe the pictures where topic-related processes are shown; paraphrasing the most common expressions; using suffixes and prefixes for word-building activities, etc.

The approach presented in our paper will presumably serve as a new tool to raise learners' expertise both in Power Electronics and topic-related English language. Our daily practice shows that encouraging students to use cards to memorize the expressions bring fruitful results not only in the problem area of Power Electronics but also in other subjects that involve using English language. Although it takes a lot of effort to take up such an energy-demanding technique of learning terms and phrases, most motivated learners adopt this method to effectively study other subjects and form their habit of memorizing the topic-related phrases. So, using the proposed techniques our students will boost their capability to speak with international partners in the problem area, to read the advanced papers and tutorials regarding electronics.

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НАБОР EDUMATRIX КАК ИНСТРУМЕНТ ДЛЯ ФОРМИРОВАНИЯ И РАЗВИТИЯ ПРОФЕССИОНАЛЬНЫХ КОМПЕТЕНЦИЙ СТУДЕНТОВ

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THE EDUMATRIX SET AS TOOL FOR FORMATION AND DEVELOPMENT OF PROFESSIONAL COMPETENCIES OF STUDENTS

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Annotation. *We suggest using the EduMatrix set in the educational process to visualize the solution of educational tasks. Using this set allows a student to develop out-box thinking, characteristic of mathematicians.*

Обучение посредством развлечения становится весомой альтернативой традиционным практикам формального университетского и дополнительного образования. Для реализации основных образовательных программ (ООП) активно используется интерактивное оборудование, мобильные приложения, событийные и игровые технологии, различные среды программирования, сеть Интернет.

Выбор организационных моделей, целевых ориентиров, соотношение образовательного и развлекательного (игрового) компонентов в ООП по естественнонаучным и математическим дисциплинам – это далеко не полный список вопросов, который находятся в фокусе интересов профессорско-преподавательского состава. Современный преподаватель должен обладать профессиональными компетенциями в различных областях науки и техники, которые оформились в виде научных дисциплин в последние годы. Прежде всего, речь идёт о наиболее динамично развивающихся дисциплинах, связанных с компьютерными науками, например, «Программирование мобильных приложений», «Обработка больших объемов данных», «Цифровая обработка сигналов и изображений». Для обучения математике, основам алгоритмизации и программирования активно используют современные инструментальные творческие среды программирования [1]. В качестве альтернативного подхода в учебном процессе применяют различные игровые наборы, конструкторы, настольные игры. Данный подход не требуют использования компьютерной техники. Среди таких наборов можно отметить EduMatrix [2], который включает игровое поле – матрицу и размеченные кубики. Игровой набор EduMatrix может использоваться для развития логического и абстрактного мышления, формирования у студентов навыков математического образа мышления и математической интуиции, способность к поиску оригинальных решений классических учебных заданий.

Цель данной работы – расширение дидактических возможностей набора EduMatrix для формирования и развития профессиональных компетенций студентов. Для достижения поставленной цели необходимо последовательно решить следующие