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AN IMPROVEMENT IN STUDENTS' CRITICAL REASONING WHEN STUDYING A FOREIGN LANGUAGE USING MATH TECHNIQUES

Abstract. This article is aimed to outline the application of Content and language Integrated Learning (CLIL) with freshman students at university which directly has a connection with Math and IT. A good knowledge of a particular science, in my case it is Math, could have a great impact on a student while learning a language. In fact, that background intelligence is often missed in the consideration of applying it when planning a lesson. However, it could be an effective push of knowledge to revise a particular topic in completely different languages. To be able to integrate language learning and prior student experience, both language instructor as well as content teachers should comprehend the basic knowledge of a combining subject and theories behind CLIL.

Keywords: Integration, Critical thinking, Math, CLIL, teaching strategies, language learning, mathematical reasoning.

Inroduction

A successful individual is distinguished by the way he or she thinks rationally, which is essential for everybody regardless of what they do for a living. Thinking logically allows you to cope with large obstacles far faster than simply following algorithms or solving problems in a traditional manner by breaking the problem into parts, thinking about each one separately, and eventually summarizing all the answers. Doesn't that sound routine, monotonous, and time-consuming?

Instead of performing large calculations and comparing procedures before finally determining the best solution, you might combine some processes to bypass comparable repeating ones or even cancel them altogether. This style of issue solving is known as critical thinking. The only method to develop your thinking is to increase your logical attitude.

The concept of subject integration has been closely examined in the academic literature, as evidenced in the publication "Elements of Integration in the Classroom". The aforementioned source presents a well-defined interpretation of integration as the process of effectively coordinating, blending, or amalgamating distinct components to establish a functional, unified, and harmonious whole. McNeil (1985) posits that curricular integration not only enables students to recognize the links that exist amongst concepts and procedures within a particular discipline, but also facilitates their comprehension of the interconnections between ideas and processes that are present across diverse disciplines, as well as in the broader external environment beyond the confines of the academic setting.

In addition, integration advantages are commonly discussed in the systematic approach for implementation of STEAM education in schools. It values the following characteristics of combining two subjects.

Combining subjects reduces workload as students can learn similar themes together. Curriculum overload is a common complaint from teachers, pupils, and parents. Working together and integration makes things more coherent and compact. Fur-

thermore, students can focus on one topic deeply. Integration is project-based learning. Learning becomes interesting and practical, with motivated students working as a team and utilizing ICT. The teaching methods are engaging, active, and similar to real-life context. Teachers have more time to work individually with learners during project-based learning. Students can focus on their interests, use past knowledge, and develop personally. Integration across subjects allows students to create unique and meaningful learning experiences. Better memory recall, practical application, and versatile knowledge transfer. Valuable skills include creativity, critical thinking, and collaboration. Integrated studies are effective in developing multifaceted expertise in students and teaching them about the importance of interrelationships in the real world.

The present discourse highlights the assumptions and analyses associated with a personalized approach towards a specific subject, as exemplified by the discipline of Mathematics through the ensuing concepts.

As it is pointed out in the article devoted to critical thinking by N. Sumarna, Wahyudin and T. Herman the construction of learning is a more teacher-centered response to the condition where students only receive the information without considering their ability to think. It has undercut the ability of students in an effort to do the analysis and synthesis. The main principle of learning is to provide a great opportunity so that students can develop the ability to think and manage this capability so that there is meaningful learning. One type of thinking skills and become the focus of this research is the ability to think critically.

Math abilities have long been considered as the most practical and rapid technique to increase student reasoning skills by researchers working on topic integration in language learning.

The authors Su, H.F., Ricci, F.A., & Mnatsakanian, M. (2016) express their outstanding ideas in the Mathematical teaching strategies: Pathways to critical thinking and metacognition. Journal of Research in Education and Science (IJRES) with the following: The sharper their critical thinking skills, the better mathematical students are able to solve problems and to formulate arguments by drawing on a wide base of knowledge. When teaching mathematics options for solving problems or during computations, teachers can assist students by expanding those math reasoning skills associated with advanced mathematics, which require a higher level of thinking, critical thinking or thinking about thinking (often referred to as metacognition). Thus, instructors should provide more options and activities that would allow students to challenge present concepts and allow them to continue expanding their mathematical abilities. Cooperative learning and metacognitive training enhance mathematical reasoning. Although metacognition has been defined simply as thinking about thinking, a better understanding of the definition of metacognition is as follows: higher order thinking that enables understanding, analysis and control of one's cognitive process, especially when engaged in learning.

The evidence of the methods being applied while learning a language at school and university levels indicate that Integration of math skills in language classes is a great option to raise student mindset. It can be used in vocabulary exercises or while exploring language rules through mathematical concepts. For instance, teaching the concept of fractions can be a great opportunity to teach students about half and one-third in relation to language concepts such as subject – verb agreement and tense agreement.

The further exploration involved the usage of mathematical activities and problem-solving exercises to help students practice their language skills. For example, reading comprehension exercises were designed in such a way that involve calculating percentages, graphing data or solving problems. Math games that require students to use language skills to play, such as Scrabble or Bananagrams, where students need to form tiles with letters were a new solution for student language intelligence enhancement.

The main difference between people and artificial intellect is that the last one needs code which has a sequential digital logic circuit been installed to find a solution just in one way, if you want to find the other ways of calculating, your online calculator should have had other codes to be installed in. To make it easier to understand you should write each way of solution as a code by formulas and circuits into the compiler to find the easiest or suitable one. Comparing all the results you could find the perfect key to your problem, but it takes a lot of time and the way you found to find a correct answer to one question, could be incorrect to another one.

However, if your skills of sorting and creating new solutions are good enough, you will not need any kind of schemes, you will generate your own ones! This is the beauty of human brain work. It may generate a whole universe of unique solutions in an insanely short period of time. The only thing you should do to level up your brain thinking process is using your logical mindset as often as possible. Inside all your new solutions out on a paper, challenge yourself and keep those skills grown.

Most universities offer critical thinking classes or extra lessons to help students prioritize the most important subjects and relieve the studying process. Instead, I had a more powerful suggestion to improve their language skills as well as increase my students' critical thinking skills, especially with those who study at math related faculties. I got an advantage from their math skills and the opportunity that they were at initial steps to acquire language. I could develop their ability to learn a language using numbers, formulas, and simple lectures on math which we used to discuss for hours. It definitely resulted in better performance both in English and math classes.

In the following paragraph I will share one of my math reasoning exercises which had a great effect on students' understanding of sentence structure in English. I should say that students came to a final conclusion after long discussions and arguments. However, their reasoning skills in English leveled up greatly not only in English sentencing but also their brain analysis showed practical results. When coming up into detail this exercise will help you to focus on one subject, think more deeply and open. To think openly you should remove all the rules of regular thinking.

I suggest moving to a more practical part of my research. Initially, it is suggested puzzling out how the mathematical combination of randomly chosen numbers works.

For example, you have got only three cards with different numbers, let them be 1, 2 and 3. And you should combine as many different three-digit numbers as possible using only these cards. The first decision is just combining numbers, and counting all the result ones. Let's do it:

123	132
213	231
312	321

The answer is you can generate only six different three-digit numbers using them.

However, it can be done by using critical thinking: as we need to build a three-digit number, and we have three numbers, as the first number we could use each one, so we have three options (op), op1 = 3. The next step is generating the second number, and now we have only two options, because we have used one before, so op2 = 2, and the last step is generating the last number, and you have got only one option left. Because you have used two ones before, so op3=1; The amount of generating numbers will be by multiplying the number of your options:

$$oP = op1*op2*op3 = 3*2*1 = 6$$

As you can see, both ways lead us to similar results. It seems that the first way is much easier and faster than the second one. But trust the process. Imagine that now, you have 6 cards, and you have to generate as many three-digit numbers as possible. Let the cards be numbered 1, 2, 3, 4, 5 and 6. Following the first way, you should write down all the combinations:

123	124	125	126	132	134	135	136	142	143	145	146	152	153	154	156	162	163	164	165
213	214	215	216	231	234	235	236	241	243	245	246	251	253	254	256	261	263	264	265
312	314	315	316	321	324	325	326	341	342	345	346	351	352	354	356	361	362	364	365
412	413	415	416	421	423	425	426	431	432	435	436	451	452	453	456	461	462	463	465
512	513	514	516	521	523	524	526	531	532	534	536	541	542	543	546	561	562	563	564
612	613	614	615	621	623	624	625	631	632	634	635	641	642	643	645	651	652	653	654

In case you are not tired by generating the numbers, you can continue counting digits, as the result you will find out that you had generated 120 ones. That one took more time, right?

Alternatively, what about doing it by using logical mindset: So as generating a first number you have got six numbers as an option, so op1 = 6; the second one could be generated using only five ones, because you have already used one, so op2 = 5; and the third one could be generated using only 4 numbers, so p3 = = 4. So, we have found out the amount of our three options, let's find out how many options do we have in common: op = op1*op2*op3 = 6*5*4 = 120

The result is the same, but application of the second method saves much more time. And most of the problems in your life are not as little as the first example, they are way bigger and intricate. So, you need to use logic to save your own time and make your life easier.

At long last, you can contribute a little to the integration of this approach while learning a language, in the example of English.

For example, you are teaching your students to combine new sentences using nouns, verbs and adjectives. And you have cards with nouns, verbs and adjectives. There are three cards with three different nouns, two cards with two different verbs and three cards with three different adjectives. Let them be:

bird	beautiful	sings
person	clever	draws
fairy	kind	

The question is, how many students will be involved to exercise, if each of them combines one sentence using these cards. The sentences should not repeat. Let's count it using the first method:

Beautiful bird sings	Beautiful person sings	Beautiful fairy sings
Beautiful bird draws	Beautiful person draws	Beautiful fairy draws
Clever bird sings	Clever person sings	Clever fairy sings
Clever bird draws	Clever person draws	Clever fairy draws
Kind bird sings	Kind person sings	Kind fairy sings
Kind bird draws	Kind person draws	Kind fairy draws

Counting the number of generated sentences, you will know that only eighteen students could be involved in the activity and write down their own sentence on a board. Using the second method we will get the answer without so much paperwork:

It can be seen in the following example, we have three types of choices: noun, verb and adjective.

As a noun we can choose each of three cards, so op1 = 3, as a verb we can choose each of two cards, so op2 = 2; as a adjective we can choose each of three cards, so op3 = 3; The total number of generated sentences is p = op1*op2*op3 = 3*2*3 = 18. As you can see the result is the same. But using the second approach is much easier.

You would probably ask me how to use this method while teaching English. Here is one of ways:

You have just taught students how to structure a simple sentence. You would like each of your students to write their own generated given words sentence. You have 30 students, and have already given them 3 verbs and 4 adjectives. Ask your students how many at least nouns you should give

them so that everyone could generate their own sentence.

Let the number of nouns be x, then the number of possible generated sentences should be more or at least equal to 30:

$$3 * 4 * x \geq 30$$

Then using math, you can find out that

$$x \geq 30 / (4 * 3)$$

$$x \geq 30 / 12$$

$$x \geq 2.5$$

Thus, it means you should give them at least 3 nouns

In conclusion, there are no ways of avoiding the cons of a particular approach while implementing it into a learning process. The practicum of likewise classes showed partial student engagement and demonstrated failure in math calculations. Another disadvantage is that opponents of this approach are always ready to collect counter facts that language should always be about a language in initial steps to acquire it. Finally, it can slow down the velocity of language learning, it could make the language proceed in long-term memory, though.

On the other hand, students who are ready to puzzle their brains, are not scared of calculations in a learning language, moreover, they contribute a lot to group work. The most essential feature of math skill application into language learning is that it makes students think carefully and generate sentences which would not allow repetition. Consequently, it leads to a vocabulary boost and better comprehension of all language domains.

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