РОЗДІЛ 4. ОПТИМІЗАЦІЯ НАВЧАННЯ ДИСЦИПЛІН ПРИРОДНИЧО-МАТЕМАТИЧНОГО ЦИКЛУ ЗАСОБАМИ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ

UDC 373.5.016:51:811.111
DOI 10.24139/2519-2361/2025.02/134-144

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THE USE OF ONLINE PLATFORMS IN THE IMPLEMENTATION OF SUBJECT-LANGUAGE INTEGRATED TEACHING OF ENGLISH AND MATHEMATICS

For the modern Ukrainian education system, the issue of integrating teaching of English and other subjects is important, which is reflected in typical educational programs for secondary schools and programs of school disciplines. Among modern approaches to learning foreign languages in terms of integrating subject content, the most appropriate for secondary school, in our opinion, is the content and language integrated learning (CLIL method), in which English serves as a means of learning subject, mathematical in particular, content and provides an opportunity to form foreign language linguistic and communicative competences. Despite the fact that the vast majority of researchers consider this method of integrated learning to be applicable only to higher education (higher education level), in our opinion, it can be applied starting from primary school using the partial integration model, since during this period of study students have quite different levels of knowledge of a foreign language and most subjects are studied according to programs approved by the Ministry of Education and Science of Ukraine, namely this model does not violate the integrity of these programs and does not require significant changes in their requirements.

For successful implementation of integrated lessons using the CLIL method, according to D. Coyle, D. Marsh and other ideologists of this method, it is necessary to introduce the following 4 elements (the "4Cs" system): Content, Communication, Cognition and Culture. Taking into account the elements of the "4Cs" system emphasizes the need for teachers to focus not only on the content of subjects and language, but also on the dynamic aspects of integrated learning, without which neither language nor subject competencies can be effectively formed.

The analysis of available sources shows that today the Ukrainian education system lacks global methodological developments of examples of integrated lessons of English and other subjects using subject-language integrated learning, therefore, for successful implementation of the CLIL method in teaching mathematics at school, a detailed study of available English-language electronic resources is required, the Desmos online platform in particular. The latter is an interesting and powerful system of various mathematical tools and a large collection of didactic mathematical materials for all levels of school mathematical education, called Amplify Classroom. It should be noted that some of the activities have been translated into different languages, but the full-text collection is available only in English, which makes this collection interesting for implementing the CLIL method in teaching mathematics. The article discusses in details the activity called Marbleslides: Exponentials, its features and possibilities of using gamified tasks, an assistant for the teacher regarding the specified activity, particularly in the context of the topic of transforming graphs of functions.

The available number of slides in the activity Marbleslides: Exponentials – 24, and their level of complexity allows us to differentiate the approach to selecting tasks for an integrated lesson for classes with different levels of learning mathematics: for the standard level of learning – you can limit yourself to slides from the Fix It groups (6 pcs.) and Predict & Verify (8 pcs.), but for the profile level – use all 24 slides. At the same time, the developers suggest that the teacher use the response mode on

the toolbar to check the progress of students, if necessary, provide them with individual support or hold a short discussion with the whole class if a sufficient number of students have difficulties. And since the considered activity from the Amplify Classroom collection is typical and fully meets the requirements for the "4Cs" elements, with the help of which the CLIL method is implemented, all this makes Amplify Classroom indispensable in the implementation of the specified method in the absence of an appropriate system of printed/electronic methodological materials in Ukraine.

Keywords: *subject-language integrated learning, mathematics teaching methodology, high school, electronic didactic materials, online platform Desmos.*

Problem statement. According to the concept of the New Ukrainian School, integrated learning should become an integral part of the modern Ukrainian education system, since it is this approach to education that encourages students to explore the connections and interactions between disciplines, relying on knowledge and skills from the relevant subject areas, critically evaluating these interactions.

On the other hand, knowledge of the English language is extremely important for the entire modern world as a whole, especially in the context of global changes and challenges, in the context of Ukraine's integration into the European and global environment.

Therefore, the issue of integrating English language learning and other academic subjects is important for the modern Ukrainian education system, which is reflected both in the Law of Ukraine "On the Use of English Language in Ukraine" (2024) [1] and in the programs of individual academic disciplines [2].

Among modern approaches to learning foreign languages in terms of integrating the content of disciplines, the most appropriate for secondary school, in our opinion, is the subject-language integrated learning (CLIL method), in which English acts as a means of learning mathematical (subject) content and provides an opportunity to form foreign language linguistic and communicative competences in an educational context. But the lack of a systematic approach to didactic materials for implementing the CLIL method in teaching mathematics requires a more detailed study of available electronic resources, in particular the Desmos online platform.

Analysis of current research. Currently, the method of subject-language integrated learning is gaining more and more popularity in higher education, and accordingly, more and more publications about its application appear. Thus, the issue of the need to integrate the CLIL method into the educational process was considered by such foreign researchers as D. Coyle (1999) [3], D. Marsh (2001) [4], (2010) [5], P. Bell (2009) [6], I. Feltzan (2021) [7], N. Olson (2020) [8] and others. Among domestic scientists, issues covering general aspects of the use of the CLIL method were addressed by O. Pershukova (2018) [9], O. Milyutina, K. Fedchenko (2023) [10], Yu. Stryrkina (2020) [11], the introduction of elements of the CLIL method into the educational process by N. Tarasenkova, I. Akulenko, O. I. Kulish, I. Nekoz (2022) [12], N. Savchenko, R. Turenko, Yu. Fedorchenko (2023) [13] and others. At the same time, targeted and systematic work on the dissemination of knowledge about the CLIL method and its integration into the educational process in Ukraine is carried out by the British Council in Ukraine and the Goethe Institute through the organization of training events for teachers, familiarizing them with the capabilities and educational potential of this technology [14], [15].

The purpose of the article. Based on the analysis of the basic concepts and approaches of subject-language integrated learning, to demonstrate the features and possibilities of using gamified tasks of the Amplify Classroom collection of the Desmos online platform for such learning on the example of considering the Marbleslides: Exponentials activity and the corresponding teacher assistant (Teacher Moves) in the context of the topic of transforming function graphs.

Presentation of the main material. The term CLIL method originated in Europe in the early nineties of the 20th century. [3], the author of the term "subject-language integrated learning" (CLIL method) is D. Marsh (1999) [4]. The CLIL method is based on the use of the language of instruction (Language 2 – L2), which is different from the students' native language (Language 1 – L1), to master the content of the academic discipline, therefore, a foreign language (L2) is learned as a result of the formation and development of linguistic competencies in order to perceive the content necessary for a specific academic subject/discipline [16]. At the same time, the CLIL method should not be a means of simplifying the content or re-studying what students already know in their native language; such an

approach makes the learning process interesting and motivating, unlike traditional approaches based on memorizing rules and vocabulary [11].

Based on the analysis of the available literature, it can be stated that the method of subject-language integrated learning is used by most teachers mainly in teaching higher education students. However, according to Yu. Styrkina [11], whose standpoint we fully share, "the method of subject-language integrated learning can be successfully applied at different ages and at different levels of education". In our opinion, it is worth starting to introduce this teaching method, starting from primary school, gradually accustoming students to this teaching method. In addition, given that the CLIL method arose from teaching natural sciences in a foreign language, conducting integrated lessons of mathematics and English using the specified technology is quite justified. Meanwhile, for a secondary specialized school, the "partial integration" (partial immersion) CLIL model is more applicable, since during this period of study students only determine the profile of their future professional activity, have quite different levels of knowledge of a foreign language (L2), and most subjects are studied according to the programs approved by the Ministry of Education and Science of Ukraine, namely this model does not violate the integrity of these programs and does not require significant changes in their requirements.

Thus we believe that the following advantages of the CLIL method, which were mentioned in [11], should be added:

- double consolidation (simultaneous acquisition of mathematical terms, concepts and language skills);
- expansion of the language environment;
- adaptation of knowledge to two language contexts;
- development of thinking (switching between languages contributes to cognitive flexibility, which in turn increases the ability to analyze and synthesize information);
- practical application (preparation for international tests, olympiads, study abroad).

For successful implementation of integrated lessons using the CLIL method, according to D. Coyle, D. Marsh and others [5], it is necessary to introduce the following 4 elements into its structure (the "4Cs" system):

1. Content – stimulation of the process of formation and development of subject competencies;
2. Communication – use of a foreign language (L2) as a means of obtaining knowledge in the subject;
3. Cognition – development of thinking abilities for studying the educational component and a foreign language;
4. Culture – understanding the characteristics of different cultures for socialization in a multicultural society, preservation of one's own culture [10].

Thus, taking into account the elements of the "4Cs" system emphasizes the need for teachers to focus not only on the content of subjects and language, but also on the dynamic aspects of integrated learning, without which neither language nor subject competencies can be effectively formed.

The CLIL method, as a teaching technology, along with its advantages, also has a number of challenges, some of which were highlighted by Yu. Styrkina [11] and supplemented by us:

1. For teachers:

- the need to develop their own knowledge of new subjects in order to effectively teach, and vice versa, for subject teachers to strengthen language training;
- carefully structure lessons in order for students to understand the content of the lesson, as well as the language through which information is transmitted;
- manage the audience in pairs, and hence develop the ability to negotiate, readiness for mutual assistance;
- consistently develop concepts for placing materials and checking task completion to make sure that the language and content of the subject are studied on an "equal" basis;
- lack of appropriate didactic materials.

For students:

- this is the difficulty of adaptation, since some students may find it difficult to adapt to learning in two languages, especially if their level of English is insufficient;

- integration of two subjects can increase the volume of material, which will require additional efforts from students.

Generally speaking, the CLIL method is a relevant method for modernizing the content of education in Ukraine and in the world as a whole. Its use during integrated lessons of mathematics and English at school is natural, but unfortunately not supported by appropriate methodological developments.

The analysis of available sources shows that today in the Ukrainian education system there are no global methodological developments of examples of integrated English and other subjects using subject-language integrated learning (the presence of developments on the well-known educational platforms Na Urok [17] and Vseosvita [18] is of a situational nature, although their number is quite large, but most of them concern primary or secondary schools); The Ministry of Education and Science of Ukraine has not developed examples of bilingual course programs (in our opinion, the main reason is compliance with the principle of autonomy of both the school and the teacher in particular). The situation is similar with bilingual textbooks and didactic materials, particularly in mathematics.

Taking into consideration the current state of development of digital technologies, for conducting integrated lessons of mathematics and English, in addition to printed didactic materials, it is advisable to use various Internet resources. The directions of such use may be as follows:

- interactive exercises using digital worksheets, embedded tasks in presentations, etc.;
- multimedia resources such as educational videos, audio podcasts, animations;
- online platforms and educational services for testing, conducting experiments in virtual laboratories, using game environments.

Compared to traditional printed didactic materials, the use of Internet resources has several advantages, the most important of which are: rapid updating of content in accordance with school programs and international standards; a variety of presentation forms (texts, audio, video, interactive modules, etc.); individualization through the ability to adapt exercises to the level of preparation of each student; promoting the formation of teamwork and communication skills in English.

The main disadvantages of using digital online resources are: dependence on electricity and the Internet availability, the presence of skills in working with digital platforms (GeoGebra, Desmos, Khan Academy, etc.) for both teachers and students. We also support the opinion of modern educational researchers [19, p.34] that, despite the possibility of diversifying educational content using online resources, the latter should be used in moderation.

The selection of educational materials for integrated mathematics and English lessons should take into account:

- the real level of students' English (A1–B1 according to CEFR);
- the clarity of mathematical content;
- the simultaneous gradual language support: glossaries, language frames ("How many…?", "The result is…") and short prompts;
- the complexity of texts: too complex can distract from the mathematical essence, too easy ones will not stimulate language development.

When conducting an integrated lesson in English and mathematics, it is important to manage the cognitive load of students. In particular, it is worth breaking the solution into stages: first purely linguistic (translation from the L2 language to the native language L1), then mathematical (understanding the condition of the problem), then again linguistic (discussion in English), and finally - combined (solution and presentation). You can use visualization ("scaffolding": drawing diagrams, mind maps, etc.), as well as modeling situations, offering students to work in pairs or groups - this reduces the pressure of the load and stimulates the production of ideas. And of course, repeating the terms "What does this word mean?" ("What does this word mean?") and structuring the task condition ("What is the connection between these data and our task?"), as well as other open-ended questions in English for the development of critical thinking. Also no less important during an integrated lesson is the use of formative assessment: written short tasks, "micro-checks" in the middle of the lesson, etc.

Among the online platforms that can be used during integrated lessons in mathematics and English using the CLIL method, there is the American platform Desmos (https://www.desmos.com/?lang=uk) which has transformed from a regular program for constructing graphic objects on a plane (graphs,

solutions to equations, inequalities and their dynamic transformations) into an interesting and powerful system of various mathematical tools and a large collection of didactic mathematical materials for all levels of school mathematical education. The latter is currently called Amplify Classroom. It should be noted that some of the activities have been translated into different languages, but the full-text collection is available only in English, which makes it interesting for integrated English and mathematics lessons. Fig. 1 and 2 show the start pages of the platform and the collection, respectively.

Fig.1. Desmos Starting Page

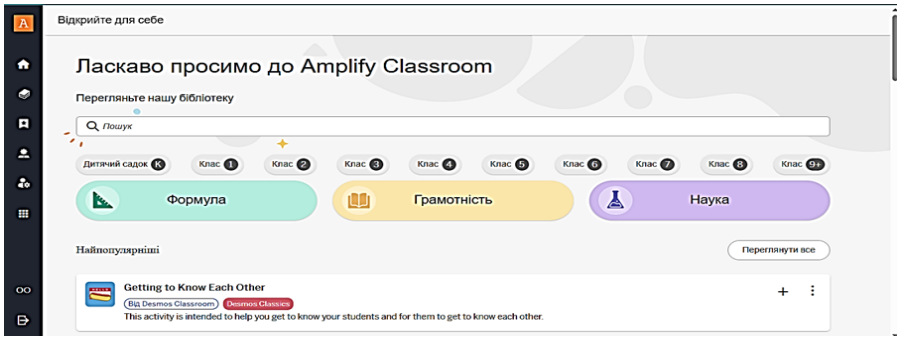

Fig. 2. Amplify Classroom Library Starting Page

It should be noted that registration on both the Desmos platform and the Amplify Classroom didactic tool system is free and possible via Google, Apple, or via email with a choice of language, in particular Ukrainian.

In the didactic tool library itself, a personal page for the teacher is created, to which he can upload activities that interest him for further use during training (Fig. 3).

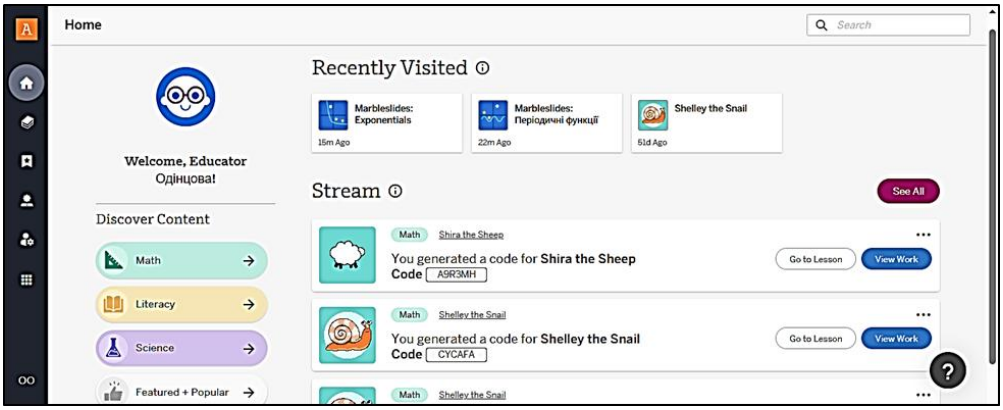

Fig. 3. Amplify Classroom Teacher's Personal Page

A typical example of the activities offered on the Amplify Classroom platform is the Marbleslides game, which deals with the transformation of graphs of exponential functions. As is known, the exponential function is widely used in the natural and behavioral sciences (in physics - when describing radioactive phenomena, finding the charge of a capacitor, sound attenuation after an explosion, in biology - when calculating population growth, the spread of viruses, in chemistry - reaction kinetics, in economics - compound interest, inflation and depreciation, exponential market growth, etc.). And knowledge of the

rules for transforming graphs of functions is also important in the context of the National Multi-Subject Test, since tasks on their use are present every year during the main and additional sessions.

The start page of the activity called Marbleslides: Exponentials (https://classroom.amplify.com/activity/566b317b4e38e1e21a10aafb?collections=651ca31cf69ee59aa9e3818a,632c77b104648305feffcfda&utm_campaign=share&utm_content=activity&lang=en) looks like the one shown in Fig. 4. At the beginning, it contains general information, such as: a description of the activity (annotation); the time for which the activity is designed; for which classes it is designed; a list of devices that are advisable to use during the activity, in particular, it is indicated that screen readers can be used for visually impaired students; a list of languages into which the activity is translated.

On the same starting page, there are various options for sharing the activity: via a link, via posting to Facebook or Twitter, via a one-time code, or providing direct access to the created classes on Amplify Classroom. It should be noted that there is a platform that allows you to export classes created in GoogleClassroom. The next part of the activity page is occupied by slides of gamified tasks (Fig. 5), which can be viewed for preliminary familiarization and correlation of actions with Teacher Moves.

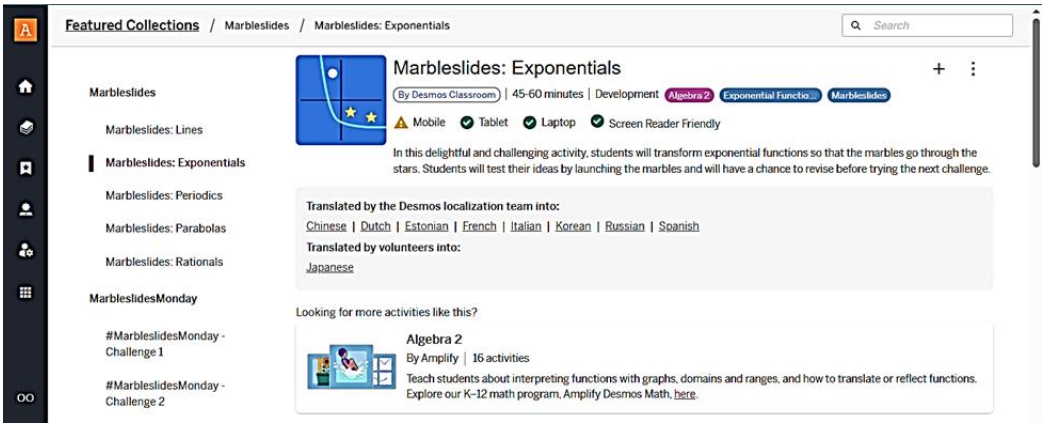

Fig. 4. Marbleslides: Exponentials Starting Page

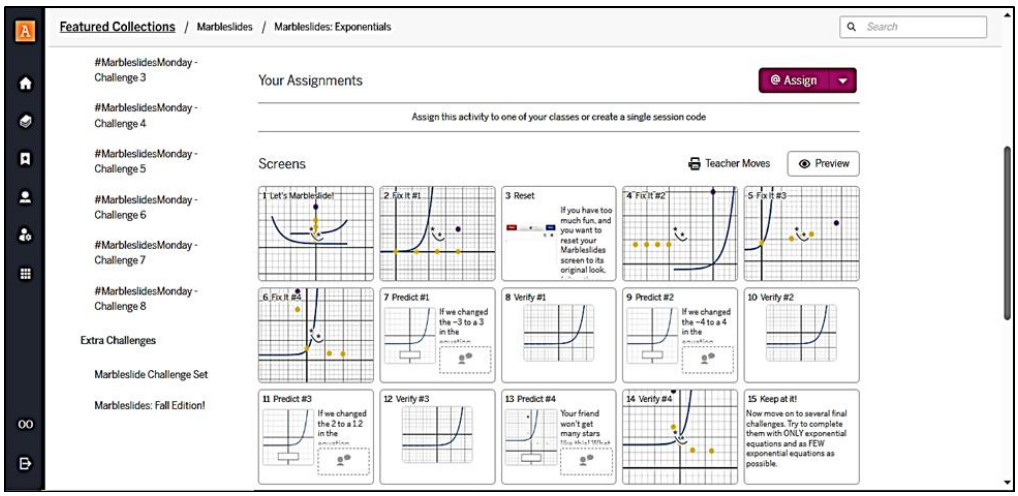

Fig. 5. Marbleslides: Exponentials Slides Page

The latter was designed to help the teacher prepare and conduct a lesson using the activity in question. Thus, at the beginning of Teacher Moves, in addition to repeating general information and a brief overview of the slides, it is suggested to determine the purpose of the lesson, its pace, and which screens will be used: one general one, or personal for each student, etc. In particular, the Teacher Moves preamble to the activity under consideration states:

"Consider these questions as you plan:

- Which screen(s) should everyone work on at the same time? Why?
- Which screen(s) do you want to keep students from seeing until you're ready for the class to see them together? (Perhaps because they reveal answers or require a whole class conversation for introduction)".

– Are there any points in the lesson where you will want to make sure students aren't playing with the screens while you discuss something as a class? The proposed set of questions is related to the fact that when completing tasks, it is possible to synchronize students' actions using the teacher's panel (Fig. 6), even in a situation where they are sitting at separate gadgets. The teacher's panel can also be used to track the progress of an individual student.

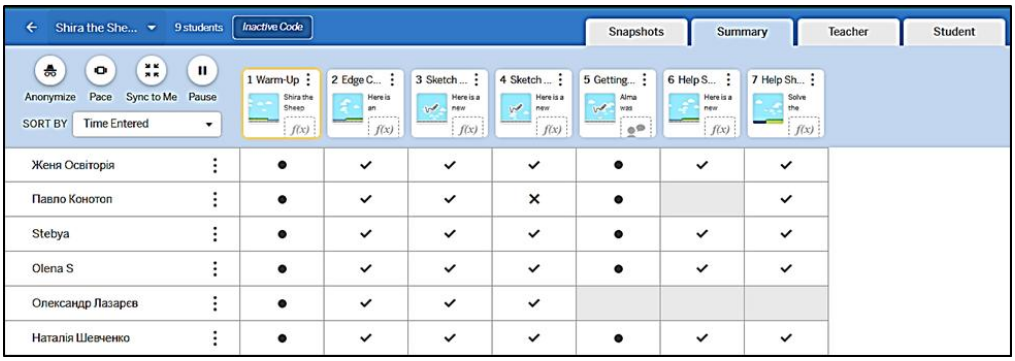

Fig. 6. Amplify Classroom Teacher Activity Panel

Next, Teacher Moves provides tips for each slide. Let's look at this with specific examples. Fig. 7 shows a screenshot of the first slide of the activity. While performing the activity, by clicking the Launch button, you can watch a purple ball fall, collecting yellow stars.

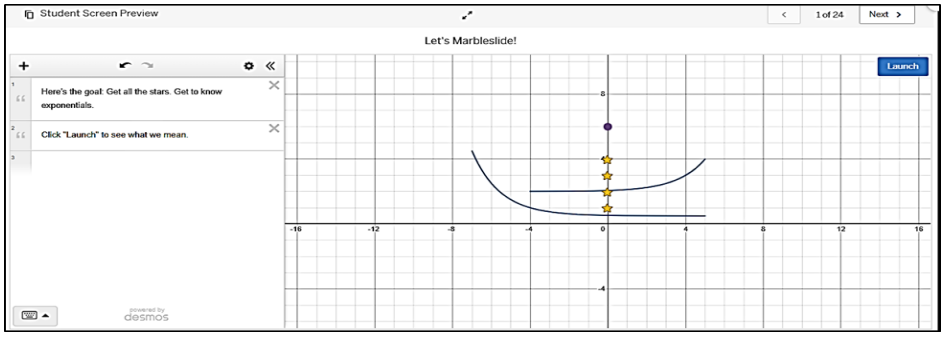

Fig. 7. Marbleslides: Exponentials Activity Slide 1

The corresponding part of Teacher Moves suggests briefly writing the teacher's actions during communication with students (Fig. 8), in particular, if this is the first time playing Marbleslides, it is worth focusing on describing the rules and goal of this game (arranging the function graphs so that the balls, rolling over them, collect all the stars).

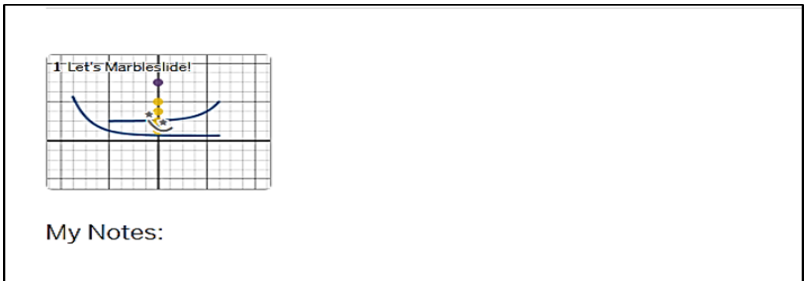

Fig. 8. Part of Teacher Moves Corresponding Slide 1 of Activity Marbleslides: Exponentials.

Starting from the second slide of the activity and in the prompts to it, the teacher is invited, in particular, to: experiment with students by changing the numbers in the expression for the function and observing the change in the position of the graph; monitor the progress of students using the teacher panel; write down a brief plan of their own actions in doing so (Fig. 9).

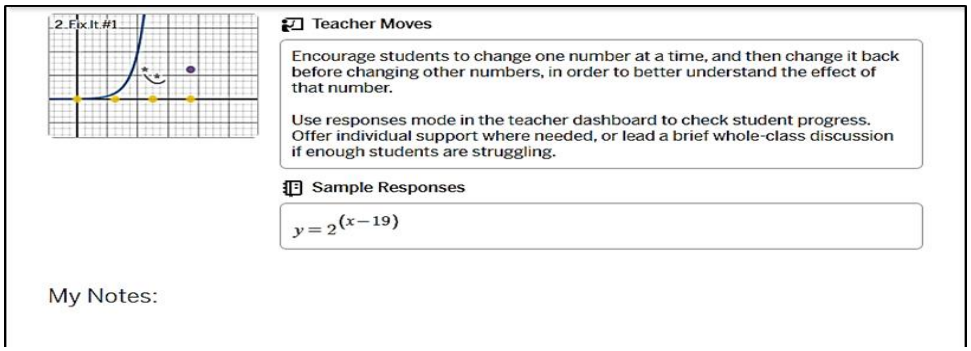

Fig. 9. Part of Teacher Moves Corresponding Slide 2 of Activity Marbleslides: Exponentials.

Some of the following slides concern other transformations of function graphs (transposition along the axes - separately for each and together, symmetry with respect to the axes, replacement of the base of the power, etc.). There are slides where the theoretical task is first proposed - putting forward a hypothesis, and then testing the guesses through an experiment. In Teacher Moves, these slides are suggested to: consider the possibility of various answers; emphasize to students that the lack of consensus is normal and even desirable; ask students to justify or question the hypotheses of their classmates and, since the lesson is integrated, do it in English.

Besides, part of the slides of the activity Marbleslides: Exponentials is devoted to creating several custom functions with such restrictions as to collect all the stars that are previously placed on the coordinate plane. At the same time, the developers suggest that the teacher use the response mode on the toolbar to check the progress of students, if necessary, provide them with individual support or hold a short discussion with the whole class if a sufficient number of students have difficulties.

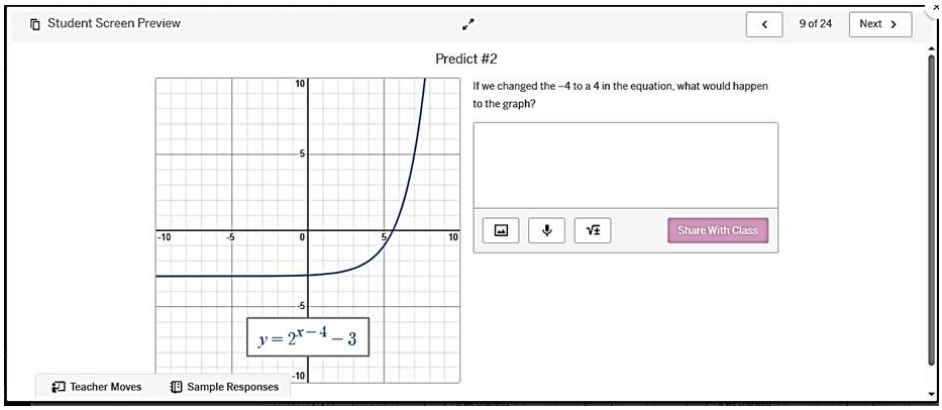

Fig. 10. Slide 9 of Activity Marbleslides: Exponentials.

The available number of slides in the activity Marbleslides: Exponentials is 24, and their level of complexity allows you to differentiate the approach to selecting tasks for an integrated lesson for classes with different levels of learning mathematics: for the standard level of learning, you can limit yourself to slides from the Fix It (6 pcs.) and Predict & Verify (8 pcs.) groups, but for the profile level, use all 24 slides.

Regarding the large amount of information and its diversity, an integrated English and mathematics lesson using the Marbleslides: Exponentials activity should be conducted in several stages:

- at the beginning, recall basic knowledge of mathematics (definition of an exponential function, its properties and rules for transforming function graphs);
- create a dictionary for the lesson, writing out terms in English that will be encountered during the activities;
- for students with a high level of language proficiency, duplicate basic mathematical definitions and rules in English, continuing to fill in the dictionary.
- spend the main part of the lesson alternating between translating the content of the slides and completing the tasks offered there. If the latter require explanations from students, then the answer can be formed, for example, in Ukrainian with the obligatory subsequent translation into English.

Conclusions. Thus, the considered possibilities of the activities of the Amplify Classroom collection, which are placed on the online platform Desmos, and their methodological support, allow us to conclude that this collection fully meets the requirements for the "4Cs" elements, with the help of which the CLIL method is implemented. The lack of a system of printed/electronic methodological materials in Ukraine for subject-language integrated learning makes Amplify Classroom indispensable in the implementation of the specified method. So, meeting the requirements of the New Ukrainian School and the educational programs of the Ministry of Education of Ukraine, the described technique could be productively implemented into the educational process. As many scholars state, it would considerably contribute to the study of mathematics and English as well as to the formation of the analytical thinking and development of communicative competences in learners and to the advancement of the Ukrainian education system.

СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ / REFERENCES

1. Про застосування англійської мови в Україні: Закон України від 04.06.2024 № 3760-IX. (On the use of the English language in Ukraine: Law of Ukraine dated 04.06.2024 No. 3760-IX.) Retrived from: https://zakon.rada.gov.ua/laws/show/3760-ix.
2. Середня освіта. Навчальні програми. (Secondary education. Curriculum) Retrived from: https://osvita.ua/school/program/.
3. Coyle, D. (1999). Supporting students in content and language integrated contexts: Planning for effective classrooms. [авт. книги] J. Masih. *Learning Through a Foreign Language – Models, Methods and Outcomes* (pp. 46-62). London : Centre for Information on Language Teaching and Research (CILT).
4. Marsh, D. (2001). *Profiling European CLIL Classrooms: Languages Open Doors.* Jyväskylä : University of Jyväskylä.
5. Coyle, D., Hood, P., Marsh, D. (2010) *CLIL Content and Language Integrated Learning.* Cambridge : Cambridge University Press.
6. Ball, P. (2009). Does CLIL work? [авт. книги] P.Alan D.Hill. *The Best of Both Worlds?: International Perspectives on CLIL* (pp. 32-43). Norwich : Norwich Institute for Language Education.
7. Feltsan, I. (2021) CLIL as a complex technology for achieving multi-target results in foreign language learning (pp. 54-62). Primedia eLaunch LLC eBooks.
8. Olson, N. (2020) The potential of CLIL for team teaching: A case study of a Japanese high school. *Conference: The JACET 60th International Convention.* August 2020. [Online]. Retrived from: https://www.researchgate.net/publication/369186227_The_Potential_of_CLIL_for-Team_Teaching_A_Case_Study_of_a_Japanese_High_School.
9. Першукова, О.О. (2018). Теоретичні основи розробки навчальних матеріалів для роботи за технологією CLIL. *Педагогіка формування творчої особистості у вищій і загальноосвітній школах,* 58-59, 162-172. (Pershukova, O.O. (2018). Theoretical foundations of the development of educational materials for work using CLIL technology. Pedagogy of the formation of a creative personality in higher and general education schools, 58-59, 162-172.)
10. Мілютіна, О., Федченко, К. (2023). Інтегроване навчання як сучасний підхід до викладання іноземної мови в педагогічних закладах вищої освіти. *Наук. записки БДПУ. Серія пед. науки.* том 3, 498-509. (Milyutina, O., Fedchenko, K. (2023). Integrated learning as a modern approach to teaching a foreign language in pedagogical institutions of higher education. Scientific notes of the Belarusian State University of Education. Series of pedagogical sciences. volume 3, 498-509.)
11. Стиркіна, Ю.С. (2020). Переваги та проблеми предметно-мовного навчання змісту та мови. *SWorldJournal.* 04-04, 39-46. (Styrkina, Yu.S. (2020). Advantages and problems of subject-language teaching of content and language. SWorldJournal. 04-04, 39-46.)
12. Tarasenkova, N., Akulenko, I., Kulish, I., Nekoz, I. (2022). The Issues and Challenges of CLIL Implementation in Higher Education: Teachers' Beliefs in the Ukrainian Context. *Journal for Educators, Teachers and Trainers,* 1(13), 249-261.
13. Савченко, Н., Федорченко, Ю., Туренко, Р. (2023). Методика CLIL під час викладання англійської мови студентам юридичних спеціальностей. *Сучасні дослідження з*

іноземної філології, 2 (24), 376-384. (Savchenko, N., Fedorchenko, Y., Turenko, R. (2023). CLIL Methodology in Teaching English to Law Students. Modern Studies in Foreign Philology, 2 (24), 376-384.)
14. CLIL essentials. *British Council. Ukraine.* Retrived from: https://www.britishcouncil. org.ua/en/teach/teacher-development/courses-qualifications/clil-essentials.
15. Goethe-Institut. Startseite. Retrived from:: https://www.goethe.de/de/index.html.
16. Khaliavka-Vasylieva, L., Zhdanova-Nedilko, O. (2022). *Використання CLIL для вивчення іноземної мови у педагогічному закладі освіти.* Zeszyty Naukowe Wyższej Szkoły Technicznej w Katowicach, №15, С. 103-112. (Khaliavka-Vasylieva, L., Zhdanova-Nedilko, O. (2022). Using CLIL for learning a foreign language in a pedagogical educational institution. Zeszyty Naukowe Wyższej Szkoły Technicznej w Katowicach, No. 15, pp. 103-112.)
17. На Урок. *Інтегровані уроки англійської мови*. (Na Urok. Integrated English lessons). Retrived from: https://naurok.com.ua/biblioteka/angliyska-mova/typ-14.
18. Всеосвіта. *Бібіліотека методичних матеріалів*. (Vseosvita. Library of methodological materials). Retrived from: https://vseosvita.ua/library.
19. Кірик, М., Данилова, Л. (2019). *Нова українська школа: організація діяльності учнів початкових класів закладів загальної середньої освіти: навч.-метод. посібн.* Львів : Світ.(Kirik, M., Danilova, L. (2019). New Ukrainian school: organization of activities of primary school students of general secondary education institutions: teaching and methodical manual. Lviv: Svit.)

Одінцова О.О., Бондаренко В.О. Використання онлайн-платформ у реалізації предметно-мовного інтегрованого навчання англійської мови та математики.

Для сучасної української системи освіти важливим є питання інтеграції навчання англійської мови та інших навчальних предметів, що знайшло своє відображення в типових освітніх програмах для середньої школи та програмах шкільних навчальних дисциплін.

Серед сучасних підходів вивчення іноземних мов у площині інтеграції змістів дисциплін найбільш доцільним для середньої школи, на наш погляд, є предметно-мовне інтегроване навчання (CLIL-метод), при якому англійська мова виступає засобом вивчення предметного, зокрема математичного, контенту та дає можливість формувати іншомовні лінгвістичні та комунікативні компетентності.

Не зважаючи на те, що переважна більшість дослідників вважають даний метод інтегрованого навчання застосовуваним лише для вищої школи (рівень ЗВО), але на нашу думку він може бути застосований, починаючи з основної школи із використанням моделі часткової інтеграції, оскільки у цей період навчання учні мають доволі різні рівні знань з іноземної мови і більшість навчальних предметів вивчають за програмами, затвердженими МОН України, а саме ця модель не порушує цілісність цих програм та не вимагає суттєвих змін в їхніх вимогах.

Для успішного проведення інтегрованих уроків за CLIL-методом на думку Д. Койла, Д. Марша та інших ідеологів цього методу потрібно в його структуру вводити такі 4 елементи (система «4Cs»): Content (зміст), Communication (спілкування), Cognition (пізнавальні здібності/пізнання) та Culture (культура). Врахування елементів системи «4Cs» підкреслює необхідність для вчителів зосереджуватися не лише на змісті предметів та мові, але й на динамічних аспектах інтегрованого навчання, без яких не можна ефективно формувати ні мовні, ні предметні компетентності.

Аналіз доступних джерел, засвідчує, що на сьогодні в українській системі освіти відсутні глобальні методичні розробки прикладів інтегрованих уроків англійської мови та інших навчальних предметів з використанням предметно-мовного інтегрованого навчання, тому для успішної реалізації CLIL методу при навчанні математики в школі потрібно детальне вивчення наявних англомовних електронних ресурсів, зокрема онлайн-платформи Desmos. Остання – це цікава та потужна система з різноманітних математичних інструментів та великої колекції дидактичних математичних матеріалів для всіх рівнів шкільної математичної освіти, що носить назву Amplify Classroom. Слід зазначити, що деякі з активностей

перекладені на різні мови, але повнотекстова колекція доступна лише англійською, що робить цю колекцію цікавою для реалізації CLIL -методу при навчанні математики.

У статті розглянуто детально активність під назвою Marbleslides: Exponentials, зазначено її особливості та можливості використання гейміфікованих завдань, помічника для вчителя щодо зазначеної активності, зокрема в контексті теми перетворення графіків функцій. Наявна кількість слайдів в активності Marbleslides: Exponentials – 24, та рівень їх складності дозволяє диференціювати підхід до підбору завдань інтегрованого уроку для класів з різним рівнями вивчення математики: для рівня вивчення стандарт – можна обмежитися слайдами груп Fix It (6 шт.) та Predict & Verify (8 шт.), а от для профільного рівня – використовувати всі 24 слайди. При цьому вчителю розробники пропонують використовувати режим відповідей на панелі інструментів, щоб перевірити прогрес учнів, за необхідності надати їм індивідуальну підтримку або провести коротке обговорення з усім класом, якщо достатня кількість учнів має труднощі.

І оскільки розглянута активність з колекція Amplify Classroom є типовою і повною мірою відповідає вимогам, що висуваються до елементів «4Cs», за допомогою яких реалізується CLIL-метод, то все це робить Amplify Classroom незамінною у реалізації зазначеного методу в умовах відсутності відповідної системи друкованих / електронних методичних матеріалів в Україні.

Ключові слова*: *предметно-мовне інтегроване навчання*, *методика навчання математики, старша школа, електронні дидактичні матеріали, онлайн платформа Desmos.

Подано до друку 21.10.2025
Прийнято до друку 03.11.2025

УДК 372.862:004.9:37.091.3
DOI 10.24139/2519-2361/2025.02/144-150

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ОРГАНІЗАЦІЯ НАВЧАЛЬНОЇ ДІЯЛЬНОСТІ УЧНІВ СУЧАСНОГО ЗАКЛАДУ ЗАГАЛЬНОЇ СЕРЕДНЬОЇ ОСВІТИ В ЦИФРОВОМУ СЕРЕДОВИЩІ ДЛЯ РОЗВИТКУ АЛГОРИТМІЧНОГО МИСЛЕННЯ

У статті висвітлено педагогічні засади формування алгоритмічного мислення учнів закладу загальної середньої освіти в умовах сучасного цифрового освітнього середовища. Автором підкреслено, що розвиток умінь логічно мислити, послідовно аналізувати інформацію, планувати власні дії та здійснювати їх рефлексію є не лише результатом вікового розвитку дитини, а наслідком системної педагогічної діяльності. Така діяльність передбачає поєднання мотиваційних, пізнавальних, соціально-комунікативних та технологічних чинників, що створюють сприятливе середовище для становлення алгоритмічної культури молодших школярів.

Особливий акцент зроблено на практичному значенні використання ігрових, дослідницьких і проблемно-орієнтованих методиках, які підвищують інтерес дітей до навчання, сприяють самостійності мислення та розвитку логічних зв'язків між теорією й практикою.

Окрему увагу приділено ролі цифрових освітніх ресурсів, інтерактивних середовищ і програмних засобів, які забезпечують можливість для візуалізації процесів, закріплення теоретичних знань і набуття практичних навичок роботи з алгоритмами.

Ключові слова: *алгоритмічне мислення; цифрове освітнє середовище; заклад загальної середньої освіти, алгоритмічна культура, міжпредметна інтеграція, алгоритмізація, психолого-педагогічні умови розвитку алгоритмічного мислення*

Постановка проблеми. У сучасних умовах цифрової трансформації освіти особливої значущості набуває питання розвитку алгоритмічного мислення учнів загальної середньої