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Quality of textbooks from the knowledge management perspective

Calidad de los libros de texto desde la perspectiva de la gestión del conocimiento

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Abstract

The COVID-19 pandemic demonstrated the importance of textbooks. They helped the learners to continue their learning in time of lockdowns. The period also raised a question: What features has to have a textbook to support learning in learner's full or partial isolation? The objective is to identify textbook's concepts and style leading to the isolated learner's outcomes equivalent to those in-classroom education. The methodology has a qualitative approach; we confront subjects' learning objectives and textbooks' content, in particular, the presence of relevant explicit and tacit knowledge. Explicit knowledge is always present because it consists of texts, illustrations, etc. Authors may forget about or occasionally neglect tacit knowledge: best practices and heuristics. The learners then cannot receive their subject's holistic knowledge, because they are unable to complete mental lifts between Revised Bloom's Taxonomy's levels. As results key features of mental lifts are identified. Based on them, strategies helping to balance explicit and tacit knowledge necessary for achieving subject's learning objectives are provided. The appropriateness of the balancing strategies is discoursed using examples from two distant subjects: Poetry and Geometry. In a stepwise manner, these examples address all mental lifts and show how such sequences can expand the learner's knowledge. To conclude the discussion demonstrated the suitability of exploiting complete sets of mental lifts. The authors can use it to make certain that no relevant tacit knowledge will absent in their materials.

Keywords: Textbook production, distance education, know-how transfer, knowledge management, self-instruction, textbooks.

Resumen

La pandemia de COVID-19 ha demostrado la importancia de los libros, pues ayudaron a los estudiantes a continuar su aprendizaje durante el confinamiento. Sin embargo, este período también planteó una pregunta: ¿Qué características debe tener un libro para apoyar el aprendizaje en el aislamiento total o parcial del alumno?. El objetivo es identificar los conceptos y el estilo de los libros que conducen a los resultados del alumnado en comparación a los de la educación en el aula. La metodología tiene enfoque cualitativo; se comparan los objetivos de aprendizaje de las asignaturas y el contenido de los libros, en particular la presencia de conocimiento explícito y tácito. El conocimiento explícito está siempre presente porque consiste en textos, ilustraciones, etc. En ocasiones, los autores pueden olvidarse u ocasionalmente descuidar el conocimiento tácito: mejores prácticas y heurísticas, por lo que los y las estudiantes no pueden recibir el conocimiento integral de su asignatura, porque no pueden completar los pasos mentales entre los niveles de la Taxonomía Revisada de Bloom. Como resultados se identifican las características clave del impulso mental; a partir de ello, se proporcionan estrategias que ayudan a equilibrar el conocimiento explícito y necesario para alcanzar los objetivos de aprendizaje de la asignatura. Se articula la adecuación de las estrategias de equilibrio utilizando ejemplos de dos temas: poesía y geometría. De manera escalonada, estos ejemplos abordan todos los impulsos mentales y muestran cómo pueden expandir el conocimiento del alumno. Para concluir se demostró la idoneidad de explotar conjuntos completos de impulsos mentales que los profesores pueden utilizar para asegurarse de que no falte ningún conocimiento tácito relevante en sus materiales.

Palabras clave: Producción de libros de texto, educación a distancia, transferencia de conocimientos, gestión de conocimientos, autoinstrucción, libros de texto.

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1. Introduction

The COVID-19 pandemic showed us the importance of textbooks and teaching aids for pupils and students. In time of limited communication, they allow the learners to continue their learning. The lockdowns on their peaks stopped the school attendance. The classes had to move into the cyberspace. Eurostat data (2021) show that before the pandemic, the saturation of households with the Internet in Slovakia was 85% in 2019. It grew up to 91% in 2020. The leap stipulates that parents are interested in their children's education. The same data indicate that almost 10% of households (and, consequently, their children) have not got their Internet connection.

(Bednárik *et al.*, 2020) state that the pre-pandemic support of distance education was both insufficient and non-systematic: The standards of e-learning were not specified; its forms, curricula and learning materials were not prepared. A half of teachers did not completed any training and was not offered sufficient room for online education. Many families, in particular those with several children, suffered due to their infrastructure – insufficient broadband, less computers than children and/or absence of quiet places to hide in during classes.

In such cases, textbooks and teaching aids represent a survival strategy. To be effective, they must be "self-supportive" i.e. to allow the learners making their progress with minimum or no educator's support. Quality teaching and learning aids help their owners to advance regardless teacher's presence (Hvorecký and Korenova, 2018). Even if the students' progress would be slower, their knowledge would expand.

In this paper, we study the features of such aids. Using an innovative way, we discuss them from the knowledge management perspective in order to propose a textbook design model. Textbooks are considered as "devices" which transfer knowledge to learners' minds. To complete the transfer, the textbooks should:

- Incorporate the subject's relevant explicit and tacit knowledge,
- Guide their readers up through all levels of Revised Bloom's Taxonomy – RBT (Bloom *et al.*, 1956; Anderson and Krathwohl, 2001; Wilson, 2016).

We have to underline the necessity to deliver both explicit (factual) and tacit (contextual) knowledge. Explicit knowledge is formal and codified – contemporary textbooks are full of it. They mostly presume the presence of educator to achieve student's progress (see e.g. Kónya and Kovács, 2022; Ziatdinov and Valles, 2022; Körtesi *et al.*, 2022).

Tacit knowledge is more difficult to express or to extract because it is primarily (and often exclusively) in our heads – in our wisdom, experience, insight and intuition. Its transfer by means of writing or verbalizing is much more difficult (Pardue *et al.*, 2000). In classrooms, it originates during verbal and non-verbal communication among teachers and learners. Textbooks and teaching aids cannot do so directly but they may enhance it for example by appropriate formulation of assignments – the tasks evoking deeper thinking. The ways of facilitating learners' deep knowledge vary and often exploit graphic representations (Schmid and Koreňová, 2022 Záhorec *et al.*, 2018; Žilková *et al.*, 2018).

Below, design of textbook structure nudging their readers to move from mechanical perception to holistic learning is proposed. The idea is a free continuation of (Hvorecký and Koreňová, 2018) and a part of our longitude research. It is now turning to the communication among learners in Virtual Reality educational environments (Korenova *et al.*, 2023).

2. Method

2.1 Definition of quality

Meriam-Webster dictionary (n.d.) defines quality as (a) how good or bad something is, (b) a characteristic or feature that someone or something has, something that can be noticed as a part of a person or thing, (c) a high level of value or excellence.

To assess quality of an entity, one has to discuss its function and its ability to fulfil users' expectations. The textbook quality can be assessed from two points of view: as an educator's companion and as a learner's guide. We are focused on the second aspect – the ability to support pupil's self-learning and its potential to develop subject-specific tacit knowledge. We study whether the textbook positively or negatively supports self-learning processes and how it is done. Hopefully, our approach is general enough to allow teachers of other subjects to get inspired.

2.2 Knowledge Management

Education enables children to acquire knowledge and skills that will help them to become successful members of society, and grow into good and accomplished individuals (Glaser, 2013). They have to acquire and to develop to kinds of knowledge: explicit and tacit. Explicit knowledge is formal and codified using an agreed notation, captured and recorded in books, pictures and videos. Tacit knowledge is in our brains i.e. seemingly impossible of "smuggling" it into learning materials. This obstacle should not stop us from trying.

The Knowledge Management theory (Dalkir, 2017) explains the knowledge development as a transition process between its various forms. Our preferred approach – the SECI model (Nonaka and Takeuchi, 1995) – is a subject-independent model describing knowledge development as a process of perpetual transition between explicit and tacit knowledge – see Figure 1. Its original purpose was to demonstrate the way knowledge is developed inside manufacturing companies and organizations. Due to its general character, it can be applied to any situation where knowledge development is a part of its internal processes.

Figure 1. *The SECI Model*

		output knowledge	
		Tacit Knowledge	**Explicit Knowledge**
Input Knowledge	Tacit Knowledge	Socialization	Externalization
	Explicit Knowledge	Internalization	Combination

The knowledge development process start with *Socialization*. Owners of tacit knowledge interact with bearers of (different, often lower) tacit knowledge. It is performed using interpersonal communication and/or intrapersonal insights. This is the most traditional form of learning and is present in any human community.

During *Externalization*, informal individual knowledge is presented into person-independent one. Pieces of tacit knowledge are presented in a standardized, commonly accepted, comprehensible format (numbers, texts, graphs, formulas, etc.). They become independent on the personality of its author, his/her geographic location or the moment of creation – and ready for their global distribution.

During *Combination*, these formalized pieces of knowledge can be processed by their users: manipulated, interpreted, rearranged, deployed and so on. In this way, the users generate new pieces of explicit knowledge.

Through *Internalization*, the new pieces of knowledge become an integral part of knowledge weaponry. People incorporate them into their brains, integrate them with their present knowledge and extend their intellectual power.

The name S-E-C-I comes from the order of activities. The innovation processes in organizations usually starts with brainstorming. Innovative ideas are accumulated and settled (S). These (still foggy) concepts are then formalized and more targeted (E). The promising ones are elaborated and made functional (C). Finally, the organizational processes/structures are modified in order to incorporate the new ideas (I). Then, the loop can start again, i.e. the SECI model represents a life cycle of knowledge with its multiple reincarnations.

In our case, we have to interpret the SECI activities with respect to pedagogical aims. Socialization includes storytelling, a dialogue, an interactive lecture, couching, mentoring etc. Externalization addresses creative writing, the selection of the most appropriate graph, illustration or diagram and so on. Combination in different subjects addresses their typical methods and techniques.

- In Mathematics: arithmetic operations, transformations of formulas, geometrical constructions, and others;
- In Poetry: Creation of new poems, rhymes, rhythms, resemblances, etc.
- In Architecture: application of new technologies, drawing building plans, understanding the space, and so on;

- In Engineering: machine invention, design and construction.

Every field exploits its own form of Combination.

Internalization includes acceptance of the Combination outcomes and its transfer to mental constructions. The individuals adopt new concepts and start using them, discussing them and applying them in their reasoning. Without proper internalization, one can remember and repeat the Combination processes but will not become comprehending their deep message.

The SECI is a versatile model of education. A typical "oldtimer" are problem solvers. By resolving a series of similar problems, the learners not only become more skilled in the operations and procedures but also accumulate experience which later help them to recognize the problem of the same category. This approach is known as Problem-Based Learning (Gijselaers, 1996). Tacit knowledge development is often discussed and developed by Communities of Practice (Duguid, 2012). Bloom's taxonomy of learning objectives corresponds to the conclusion that "the understanding that not all knowledge and expertise resides in the academy, and that both expertise and great learning opportunities in teaching and scholarship also reside in non-academic settings" (Fitzgerald *et al.*, 2002). Our below approach exploits the SECI model born in a non-academic environment. The application of Knowledge Management in educational environment becomes more and more popular (see, for example, Tee and Karney, 2010; Saunders, 2022). The SECI model has been applied to the analysis of various education-related activities like effective teamwork (Dávideková and Hvorecký, 2017) or managing not-fully-rational knowledge (Hvorecký *et al.*, 2013).

Further, we exploit it for the specification of design and development of quality textbooks. Our principal research method is Learning and Development (Harrison, 2009). After selecting a phenomenon (a piece of knowledge we wish to deliver to learners), its key features are analyzed. Then, the textbook author crafts a problem/task which requires to apply previous knowledge and experience of the learner. Naturally, the step from the previous knowledge to the newly-born one must be rather small to allow its "rediscovery" by untrained individuals. Due to their effort, the learners may gain a piece of knowledge which was not put down in the textbook. Consequently, the textbooks may offer tacit knowledge by posting it "between lines". When properly incorporated, this strategy opens door to unwritten but potentially useful pieces of knowledge. Such textbooks will allow learners to find them either independently or with minimum support from a third body.

2.3 Reaching Learning Objectives

We have to specify the learning objectives first. Then, they have to be expressed by pieces of knowledge (both explicit and implicit) and, finally, to design patterns which serve to the learners as generators of their (unknown) instances. Each generator should allow them to forward from isolated examples to their "mass production" applicable in the particular discipline.

The key to success is to identify the type of tacit knowledge to be delivered to students. Bloom's taxonomy offers an optimal scaffolding. It specifies a hierarchy of levels the person should achieve as a result of his/her learning. Most frequently, it is presented by a series of verbs Remember, Understand, Apply, Analyze, Evaluate, and Create (sometimes denoted as Synthesize) interpreting in the following way:

I **Remember** data, formulae, terminology, laws, ...;
II **Understand** relationships, purpose, links, ...;
III **Apply** in a new situation, upon a request, …;
IV **Analyze** significant features, identify reasons and potential risks, ...;
V **Evaluate** statements and their supportive arguments, assess outcomes, compare advantages and drawbacks, ...;
VI **Create** plans, design and develop, produce, innovate, …

The order of taxonomy levels expresses growing complexity of thinking. According to (Lord and Baviskar, 2007), the taxonomy allows the instructor to gauge the level of questions asked on the exams. For example, "if a question on the test asks students to identify a structure defined in a sentence or shown on a graphic, the instructor knows the query fits in level one …" If students are asked to

interpret a graph or predict what would happen if a certain event was to continue, the question would require stronger thinking and resides at a higher level. Table 1 shows a lists of verbs typical for tasks at each level (Clark, 2004).

Table 1. *Leading verbs in tasks*

Level	Leading verbs of the tasks
Remember	Define, duplicate, list, memorize, recall, repeat, reproduce, state
Understand	Classify, describe, discuss, explain, identify, locate, recognize, report, select, translate, paraphrase
Apply	Choose, demonstrate, dramatize, employ, illustrate, interpret, operate, schedule, sketch, solve, use, write
Analyze	Appraise, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, test
Evaluate	Appraise, argue, defend, judge, select, support, value, evaluate
Create	Assemble, construct, create, design, develop, formulate, write

Before testing their knowledge, the learners have to gain it from a relevant source: their educators or literature. This paper discusses the principles of creating teaching aids which may reduce supportive person's presence. In a sense, our aim is "reverted" to the traditional SECI model. Prior to extracting knowledge from students, we have to implement it to their brains. To a certain degree, it is done today. For example, Mathematics textbooks contain both solved and unsolved problems. Every solved one expresses a piece of explicit knowledge – an application of solution method. The unsolved ones may be formulated in three ways: (a) as another application of the same accustomed method, (b) as a more complex task in which the membership to a family of problems must be identified first and only then the problem can be solved, (c) as an open problem absolutely new to the learner.

The latter two groups require tacit knowledge of higher ("meta") level. As the ability to formulate an analogy or to demonstrate creativity belong to tacit knowledge, problems of these categories provide opportunities to "smuggle" tacit content. Naturally, the first tasks requiring discoveries must be transparent and easy to solve. Otherwise they could repel the learners and they would resign to them. The textbook authors might offer hints, too.

Textbooks have to contain a variety of fundamental strategies of tacit knowledge development. They should support the readers' comprehension of questions presented in Table 1 and nudge them to react appropriately. Examples are given below. Before we do so, we have to stress an additional aspect of the process. Unlearning wrong practices is not an easy task (Love *et al.,* 2018; Jordan and Karunananthan, 2020). To protect students from gaining faulty knowledge, the authors should also point to potential errors in solutions and explain what makes them inappropriate. As no one can know the exact wording of the future (not-yet-posed) questions, an optimal explanation should offer examples of both ("positive" and "negative") tacit knowledge. Let us exemplify it. Two next tasks look as problems solvable by "the rule of three":

- *One horse weights 700 kg. What is the weight of 10 horses?*
- *A horse can carry a load weighting 60 kg. What load can be carried by 10 horses?*

They offer an example of "positive" analogy: the solution of the first one gives a hint for solving the second one. It indicates that there is a group of "rules of three" problems. Their common formulation sounds: *The feature X of a horse has Y as its value. What is the value of feature X of 10 horses?* (With 10*Y as their solution).

The "negative" case shows that there are exemptions and not all problems which look similarly can exploit 10*Y as their outcome: *One horse runs at speed 20 km/h. What is the speed of 10 horses?* A wrong analogy suggests "10 * *20* km/h". Its (correct) rejection requires additional (contextual) knowledge saying that "the speed of caravan is the speed of the

slowest camel". If a student makes a mistake, he/she can be prompted to the right conclusion by asking whether the speed of ten cars driving on a highway also sums up.

There is another "negative" variation of the same problem: *One horse is of white color. What is the color of 10 horses?* It demonstrates that the visual similarity of two texts does not assign them to the same category of problems. This problem even does not belong among mathematical ones. Its non-solvability using any mathematical method is an important piece of knowledge in Mathematics.

The above statements propose the pillars of teaching aid design:

- Present and explain standard terms, methods and approaches typical for the given field;
- Present also typical incorrect solutions and explain why they are wrong or do not function;
- Demonstrate the limit of the discipline; show that no field of human knowledge is omnipotent.

As a result, the learners will become capable do more than just to demonstrate their knowledge by responding future questions. They will understand whether the question belongs to a field and to explain why. They will be capable of discussing whether a problem is solvable by the means of the discipline or not.

The examples below will illustrate the introduction of these concepts at each level of Bloom's hierarchy in the belief that the field specialists can create appropriate ones for their particular fields. To achieve that, we interpret Bloom's hierarchy in a less traditional way – as a series of mental lifts allowing more and more complex reasoning corresponding to a growing intricacy of problems.

2.4 A specific of the lowest level of Bloom's taxonomy

The first level – *Remember* – presumes the simplest reasoning. It requires no more than an adequate reaction to "define, duplicate, list, memorize, recall, repeat, reproduce, state". No tacit knowledge is needed except of the capability to interpret the request. It corresponds to „remembering by heart" – a word-by-word repetition done without any comprehension of meaning. A common example is *Jabberwocky*, a poem by Lewis Caroll (1865). There are its first four verses:

Twas brillig, and the slithy toves
Did gyre and gimble in the wabe:
All mimsy were the borogoves,
And the mome raths outgrabe.

It is an extreme example of a first-level piece of knowledge. It is remembered, recited and popular despite having no meaning.

2.5 Lifting to the higher levels

Unlike the first level, in all higher levels concept's comprehension is a must. Reaching the next level requires additional knowledge – a mental lift. Under the mental lift we understand a qualitative upgrade in learner's knowledge similar to Archimedes' heureka "jump" change (Deckert, 2007). It presumes an inquiry approach and is suggested as a key approach to quality education (Trash, 1978).

Table 2 sums the properties of mental lifts. Every mental lift occupies a row. Its leftmost member represents learner's initial knowledge, the middle one the target one. Its right member describes the learning objectives which presence demonstrates that the mental lift has been done. The main aim of our research was to identify the tools and strategies which develop these elements of learners' tacit knowledge which facilitate the particular learning objectives.

Table. 2. *Neighboring pairs in Bloom's taxonomy*

First member	Second member	Mental lift
Remember	Understand	To become capable to explain the concept and/or the relationship within its field-related context.
Understand	Apply	To find a way the concept/method/procedure can resolve a given problem (when the problem is solvable within the field).
Apply	Analyze	To learn to explain one's solution, its steps or components and their role in the process.
Analyze	Evaluate	To achieve such level of knowledge when the solving method becomes more important than the problem itself; to compare two or more related solution methods and to contrast their advantages and disadvantages.
Evaluate	Create	To build one's own structure of knowledge and become competent to exploit it for forming original solutions, concepts, objects or problem solving procedures.

3. Results

All textbooks contain externalized (i.e. explicit) knowledge: written text, tables, graphs, illustrations and so on. For the aims of this paper, these items are the sole information source of students' learning. In other words, the learners see the left members of Table 2 as pieces of explicit knowledge. The complete their mental lifts, they have to acquire this explicit knowledge and join it with tacit knowledge they acquire by exploiting the textbook's "between-lines" information.

From the point of view of the SECI model, all textbooks are information sources encoded using formal symbols i.e. products of Externalization. Their authors externalized their tacit knowledge, while the readers read them in order to achieve its Internalization. In an optimal case, tacit knowledge (of the author) will be replicated in the learner's mind. It implies that our considerations have to start in the Combination field – with the texts interpreted as pieces of externalized knowledge. The learners read and study them to get them internalized. After doing so, they can think about and discuss them. From the point of view of SECI, the learners "socialize" (individually or in groups). Nevertheless, to demonstrate their comprehension, they must then present their recently gained knowledge in a pre-defined, requested format i.e. to externalize it. The loop is closed.

3.1 Poetry

Let us explain the role of mental lifts by continuing our Jabberwocky example. Its words do not have meaning – they simply follow a rhythm and rhymes. Nevertheless, one can build a quite deep knowledge on poetry upon it. Let us move upon the ladder:

- Understand: The step to it is based on posing the questions: *Why does the text resemble a poem? What is a rhyme?* The answer should be accompanied using a series of onomatopoetically sounding pairs of words from Jabberwocky or other poem as well as some pairs which do not rhyme. The textbook should contain good rhymes, bad ones as well as "foggy" ones – those of questionable quality. The last ones can later serve as reference points during discussions on rhyme quality later.
- Apply: *Find other pairs of rhymes.* For this mental lift, the quality of rhyme does not play any role. The text should prompt the student to produce anything he/she considers being a rhyme.
- Analyze: The writing should explain *what makes good quality rhymes*, which ones are not such and why. Then, the learner should explain which of his/her previously formed rhymes he/she considers the best one(s) and why.
- Evaluate: Sample poems of various quality are posted. The students are asked to make an independent analysis of poems. They for example should *study the rhymes not only as isolated words* but discuss whether they comply with the poem's main idea. One may start discussing gentler distinctions like "not excellent but supporting the poem's style" or "intentionally bad in order to catch the reader's interest" and

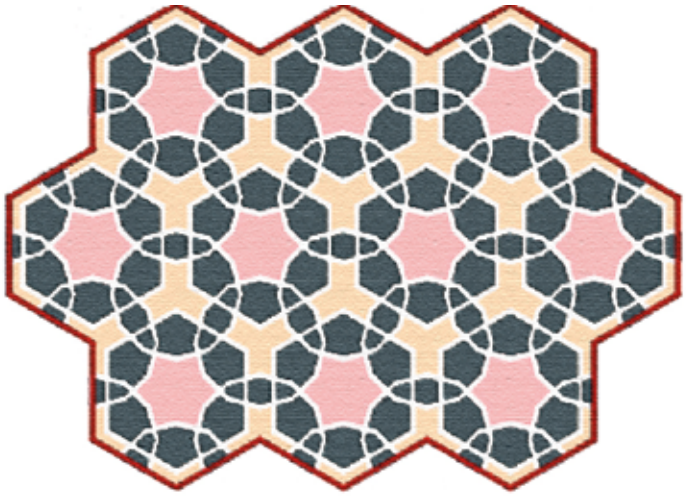
similar. Their conclusions should express the role of the rhyme as a tool for expressing idea, not only as an esthetic element.

- Create: The students are asked to *create a poem.* As they may face problems with their leading topic, their outcomes might be a Jabberwocky-like non-sense poems.

3.2 Geometry

To achieve a deep and relevant comprehension of the learning materials, they must be interesting/attractive. In poetry, Jabberwocky is the bait. In planar geometry, symmetry is a good bait – see Figure 2. It catches learners' attention by presenting a body which exploits mathematical principles to express beauty.

Figure 2. *Symmetrical tesselation*



Note: (Majewski, 2011)

There is another similarity between the baits. Both poems and symmetrical patters are uneasy to create. Making them is a challenge. According to (Meriam–Webster, n.d.), symmetry is a correspondence in size, shape, and relative position of parts on opposite sides of a dividing line or median plane or about a center or axis. Around us, there are many items featuring symmetry: flowers, snowflakes, human faces, etc. As a result, the learners can also understand the connection between them and the learning matter. A series of mental lifts should therefore lead them from their intuitive familiarity with symmetry to its geometrical interpretation and construction.

- Understand: *Is this object symmetrical or not?* No one can remember all symmetrical objects he/she have seen but can easily recognize them even without a specific course. It is because each of us intuitively learned the concept long before enrolling his/her primary school. The textbook should show many figures, stress that the list is not exhaustive and ask for its expansion. Less standard responses like "openings on a violin, a bridge or a church façade" should be higher valued, especially when they address rotational symmetry or point symmetry. The "negative" part of this mental step has to point to nonconformities – the ability of learner to recognize why a pattern is not symmetrical and what are the deviations in it.
- Apply: *Create a symmetrical object!* There are many ways to do it. For example, by cutting a folded paper one can create objects with reflectional symmetry, point symmetry and rotational symmetry. The examples on each of them should provide the text. Then the learners should be asked to make these symmetrical objects – and also to explain what cuts may distort symmetry.
- Analyze: Now it is time to *distinguish among different types of symmetry*. The text will explain the principles of reflection and rotation and asks the learners which operations lead from Pattern A to Pattern B. Encourage the

learners to investigate/measure distances of identical elements from the folding line and/or the body center. Their observations should be expressed using terms of geometry.

- Evaluate: The learners should *discuss their obtained data* and look for differences between different types of symmetry. Their outcomes should guide them to understanding the dependence on the distance from the axis (in the case of reflection) and from the center (in the point symmetry). The advanced problems may address the rules of rotational symmetry. All findings should be "translated" into the language of geometry.
- Create: The student will *create symmetrical objects using the geometrical rules* following the previously learned rules and procedures.

4. Discussion and conclusion

Textbooks should provide a lot of space for individual work. The problem should be of both sorts – solved and unsolved – to give them a necessary feedback and to minimize their blundering. At the same time, the country-wide school systems expect a certain unity of learning objectives in order to "unite" outputs of education across the country and, in a way, worldwide. For a comparison, the educational standards for symmetry valid for the U.S.A. and the Montana state (Knuchel, 2004):

"National: 1. Identify and describe line and rotational symmetry in two-dimensional shapes and designs. 2. Predict and describe the results of flipping and turning two-dimensional shapes. 3. Build and draw geometric objects. 4. Create and describe mental images of objects, patterns, and paths. 5. Describe location and movement using common language and geometric vocabulary.

State: 1. Explore properties and transformations of geometric figures. 2. Use geometry as a means of describing the physical world."

These goals are in a good correspondence with Geometry goals around the World; they are also closely related to above mental lifts. Their order in the syllabi and the method of achieving them depends on the textbook authors. In our case, they correspond to the constructivism and problem-based learning. To catch learners' attention, one should exploit their familiarity with the taught concept and childish curiosity. The combination of these factors allows bridging their current intuitive knowledge and future advanced one. In accordance to (Brindha, 2018), it not only facilitates the student centered pedagogy but affects digital approaches for applying the principles of good assessment and instant feedback.

Notice that the steps – the mental lifts – are short and always lead from a piece of explicit knowledge to another piece of explicit knowledge:

- Understand ends with the ability to exemplify the concept using real-life examples;
- Apply leads to presenting learner's solutions;
- Analyze results with learner's findings of concept's properties;
- Evaluate targets quality of these concepts from the point of view of the given discipline (poetry, geometry, and so on);
- Create crowns the process with the learner's demonstration to exploit his/her knowledge for crafting original products.

Considering the terms of SECI model, each mental list starts in the Combination field. To complete his/her mental lift, the learner first combines his/her previous knowledge with the proposed one. He/she is supposed to internalize it (read and comprehend the text, study the picture, interpret a drawing,…). Due to its Internalization, he/she is capable of thinking about it. Notice that Socialization includes not only dialogue with others but also self-reflection ("talking to yourself"). In all cases, the activity should motivate and inspire him/her. Finally, the outcome is externalized and presented in an appropriate format – the given mental lift is completed.

The Socialization stage is the most critical for the success of learning. Without a relevant mental processing (or a guidance), the learner can fail on making desired conclusions. According to (Aguirre-Aguilar, 2020), learners need feedback. As a best solution, an expert evaluation and/or advice is recommended. In traditional education, the expert equals the teacher. As we are considering an (at least partial) isolation typical for the online environment, it can be a companion website (Nilssen, 2015). In general, the support can be done by anyone or anything capable to facilitate learner's knowledge.

The textbook which contains all mental lifts steers knowledge to its higher quality. The readers

will not only be capable of more intensive comprehension of content, they will incorporate their authors' knowledge more easily and in accordance with the learning objectives and their previous knowledge structures.

Quality is enhanced by modified order of SECI steps:

- In traditional classrooms, the step order is S-E-C-I (i.e. from tacit knowledge to tacit knowledge). The teacher introduces the topic using an informal (verbal) way and only then expresses it in its formal (written) way. In the end of the loop, learners demonstrate its possession during interaction with educators and classmates.

- In above considerations, the order is C-I-S-E i.e. it goes from explicit knowledge to explicit knowledge. The loop starts with reader's interaction with textbooks. He/she then internalizes their content and mentally processes it. This process ends with gaining a new piece of knowledge. To prove its possession, the learner presents it using concrete texts, illustrations and data.

To make the textbook approaches close to those in classrooms, the textbook should exploit a less formal writing style. Such style often appears in books on popular science, for example (Chamovitz, 2017, Sverdrup-Thygeson, 2018) on biology or (Hvorecký, 2018) on physics. Improved legibility of communication plays a crucial role in other fields too, for example in database query design and development (Hvorecký *et al.*, 2010).

Despite of the textbook capability to support self-learning, the learner's progress will often be quite slow. Not to repel readers, the books must not be heavy and their visual and wording style have to be attractive. There should be enough tasks allowing the reader to train themselves using sufficient numbers of correct and incorrect solutions.

For the authors, it implies the necessity to incorporate various hints facilitating learner's subconscious knowledge. Forming and exploiting several stepwise series of tasks following the Bloom's taxonomy ladder is a must.

It implies that the proposed method closely relates to microlearning, too. (Hug, 2007) underlines that the role of microlearning has to be reconsidered deeply despite the fact that it has been an implicit part of discourses for decades. As we have seen above, this methodology is applicable to the textbook creation, too.

Two additional aspects have to be underlined:

a. The portions of new knowledge must be formed as "edible chunks" – small and self-supportive. They should be a combination of brief explanations mixed with relevant simple tasks. By "simple" we mean their capacity to be comprehended by all readers. Responding them will enhance the readers' self-confidence. Naturally, there must also be non-trivial questions challenging them but their higher difficulty must be clearly stated. It especially applies to the examples of wrong or incomplete solutions because they could confuse the learners and prohibit their comprehension of subtle deviations from the correct ones.
b. In principle, the order of sequence elements should follow Bloom's hierarchy. The learner should move through the levels one by one. The exceptions are possible but they should remain exceptions. For example, habitually it is not easy to decide whether to prefer Evaluate to Create – or to use their opposite order. The writer should eliminate both options.

Finally, let us to underline that writing textbooks is an art. The authors should be given their liberty to follow their wisdom and their privilege to reject any of our above suggestions. Nevertheless, every art has to follow some elementary principles. For example, the art of sculpture has to respect the principles of statics otherwise the sculpture will collapse. Only those who successfully combine the principles with their own creativity produce successful results.

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