

# Multimedial Refocalizations of Attention in Digital Learning: An Interdisciplinary Model

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## **Abstract**

*Some years ago I created a digital-learning-related teaching model for higher-education purposes and called it HY-DE model (to be described in detail below) as it was based on the HYper and DEep modes of attention.<sup>1</sup> It was meant to respond to the new learning environment of the digital world, which called for innovative teaching models. The theoretical model started from the circumstance that the communicational and information-searching as well as learning habits of what I term the “bit generations” (generations Y and Z) have changed; that students of the digital world have attained extremely high stimulus threshold, a refined sense of the visual, and can be characterized by an emphatic presence of hyper attention. The model works with manipulating the phases of hyper and deep attention with the help of the digital environment: starting out from the hyper phase, attention is gradually steered towards the deep phase, where serious learning can take place.*

*The modeled process is multidisciplinary as it comprises several disciplines. The semantic networks of the individual disciplines (discipline [=a branch of science], discipline [=rules, regulation, rigor], and disciple [=pupil, follower, student]) are all there in the way the HY-DE model operates. They refer simultaneously to research area, regulation of research (inclusive of normative methodological rigor), and teaching, which introduces the student into the terminology and methodology of the given research area. The involved disciplines transgress their boundaries, though, exerting their combined effect through a division of labor as it were (Barry, Born, & Wieszkalnys, 2008). Thus self-contained disciplines transcend their own constraints to attain HY-DE objectives in synergy, yielding a new pattern of learning and more effective teaching.*

*It is in the affinity and interface of the various independent disciplines, subdisciplines, and branches of learning where interdisciplinarity develops, in which the theory of the method is grounded. I availed myself of the research methodology, terminology, and relevant research results of psychology, cognitive psychology, brain research, philosophy, narratology, pedagogy, digital pedagogy, reading research, sociology, learning theory, educational assessment and*

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<sup>1</sup> I introduced it (a purely theoretical model at that time) at ICSIT 2015. It was published in the *Journal of Systemics, Informatics and Cybernetics*, 2015, 13, 6 as The HY-DE Model: An Interdisciplinary Attempt to Deal with the Phenomenon of Hyperattention.

*measurement, digital literacy, and applied informatics. Some of these areas are interdisciplinary in themselves. Thus my model can be regarded as based on multi/interdisciplinarity, doubly or even several times over.*

**Keywords:** *inter/multidisciplinarity, higher education, learning and teaching, HY-DE model, digital learning, guided attention*

## **1. Introduction—The interdisciplinary within multidisciplinarity—in the context of how the HY-DE model works**

This study will focus on the inter/multidisciplinary aspect of the model, foregrounding a strictly consistent application of different relevant theories by synthesizing disciplinary and interdisciplinary concepts and methods to describe HY-DE's stage and phase functions (of these below) and the novel phenomena that manifest themselves in this framework. In full awareness of the fact that scientific communication resulting from combining different branches of learning is often defined as transdisciplinarity in higher education; moreover, “multi-,” “inter-,” and “transdisciplinarity” are often used synonymously, I need to establish how I conceptualize “interdisciplinary.”

The discussion to follow will apply the definitions proposed by Bernard C. K. Choi and Anita W. P. Pak.

*“Multidisciplinarity draws on knowledge from different disciplines but stays within the boundaries of those fields.*

*Interdisciplinarity analyzes, synthesizes, and harmonizes links between disciplines into a coordinated and coherent whole.*

*Transdisciplinarity integrates the natural, social, and health sciences in a humanities context, and in doing so transcends each of their traditional boundaries” (Choi, Pak 2006, 359).*

It follows from these definitions, the HY-DE model is multidisciplinary, as already mentioned, since it uses the results of several, always already interdisciplinary areas and (sub)fields of science. Its methodology can be described as interdisciplinary, of the Kuhnian hybrid kind,<sup>2</sup> operating with these disciplines and subdisciplines of science in a coordinate, coherent,

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<sup>2</sup> Thomas Kuhn's model conceives of interdisciplinarity as a hybridization process, interdisciplinary fields being hybrids. (Quoted in Bogdán, 2004.)

rigorous, and consistent fashion. All involved areas are humanities and social sciences in the broader sense (plus digital technology),<sup>3</sup> therefore Choi-Pak's category of "transdisciplinarity" is irrelevant *per definitionem*. Admitted, as indicated above, that educational sciences indulge in particular preference for transdisciplinary approach and interpretation.

In presenting the model I wish to go beyond demonstrating how the involved areas of science enter into a joint discourse; my intention is to stress the plus value resulting from their interaction as opposed to what they represent separately (in and by themselves). What is attained when the model is deployed is what the modern understanding of interdisciplinarity defines as the integrative-synthetic mode (Barry, Born, & Wieszkalnys, 2008). It means that two or more disciplines meet in the HY-DE stages in such a way that the given stage- (and phase-)specific problems can be solved through their interaction only. Thereby a new product comes about, in which it is no longer a requirement that the original identity of the included disciplines should be fully recognizable. They serve as input factors supporting the process of learning and comprehension.

Disciplinary synergy generates a new quality, a new instructional model, whose efficiency can be ascertained by means of pedagogical measuring and evaluation. It means that proving the efficiency of the model's practical application makes a postmodern view of, and approach to, HY-DE's multi/interdisciplinarity possible if we take the dimension of the postmodern understanding of interdisciplinarity, which maintains that theoretically-based research approach is needed when applicative-practical tasks are attempted (Klein, 2006). In our case, the practical application of the theoretical model "liberates" and activates the creative energies latent in the instructor's and the students' viewpoints, experience, and knowledge (in the instructional and the student phases, alternately). Without that creativity and innovative cognition the subject-matter of teaching cannot be based on the HY-DE model by the teacher, and the practical assignment cannot be accomplished by the students after all.

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<sup>3</sup> As for science systematics, the classification of the Hungarian Academy of Sciences is used here, which distinguishes two divisions of learning: 1) natural sciences (inanimate and life sciences) and mathematics; 2) humanities and social sciences. <https://mta.hu/doktori-tanacs/tudomanyagi-nomenklatura-106809>

The model is in full accord with the three constituting elements of the Salter–Hearn map of interdisciplinarity:<sup>4</sup>

1. knowledge as instrument (it responds to problem-based, external demands)
2. new synthesis of knowledge (it challenges existing disciplinary structures by introducing new conceptual systems and methods)
3. critical interdisciplinarity (interdisciplinary logic, the classification and categorization of interdisciplinary activity)

All three constituents aim at problem-solving—one of the aims that the HY-DE model also sets forth in that the learning-by-doing philosophy is translated into practice through problem/task-solving.

The spirit of interdisciplinarity pervades every phase of the HY-DE structure: the process, the method of intervention, and the result. What can be called interdisciplinary gradualness is a main feature: top-to-bottom gradation in the first, instructor’s stage and from the bottom upward in the student stage (see later below).

Rigor is also present through and through: in the prudence of the planning and the structure, in its regulation, in its controlled, rule-guidedness. As we will see, HY-DE’s interdisciplinary communicative rigor can be described as “Interdisciplinary Dialogic Rigor” (Callaos & Marlowe, 2020, 4).

On the other hand, if we take Lattuca’s types of interdisciplinarity into consideration, our model exhibits mainly the features of synthetic interdisciplinarity, according to which “[s]ynthetic interdisciplinarity implies

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<sup>4</sup> The interdisciplinary map of Salter and Hearn: “Conceptualizations of interdisciplinarity generally recognize differences in the intellectual work that occurs in relation to given disciplines; some forms of interdisciplinarity involve more comprehensive, profound, or complete integration of disciplinary knowledge and methods than other forms. Various authors make these distinctions, either implicitly or explicitly. Salter and Hearn (1996), for example, distinguish between ‘instrumental interdisciplinarity,’ in which scholars utilize or borrow the ideas or methods of another discipline to enhance problem solving within their home disciplines. This interdisciplinary work accepts the social and institutional premises of the prevailing disciplines. A more extreme challenge to the legitimacy of the disciplinary structure is presented in an approach, called ‘conceptual interdisciplinarity,’ that critically examines assumptions of institutional and social power embedded in disciplinary work. To Salter and Hearn, interdisciplinary approaches reflect differing degrees of ‘challenge to the limitations or premises of the prevailing organization of knowledge or its representation in an institutionally recognized form’” (Aram, 2004, 43).

a tighter linking of disciplines through courses or research questions. Courses and research questions that cross disciplines represent transdisciplinarity, and conceptual interdisciplinarity reflects intellectual pursuits that have no compelling disciplinary basis and that are new intellectual spaces” (Lattuca 2001, quoted in Aram 2004, 383).

## **2. HY-DE’s interdisciplinary-rigor consistency, and how it works**

The HY-DE model was designed expressly for the higher education teaching and learning environment. As it has already been mentioned, it was prompted by an intensification of digital-world-related phenomena and the changes that the cognitive functions (knowledge-acquisition, information-processing, and cognition) of the bit-generations underwent. Its main structuring principles are the theory of hyper and deep attention as developed by Katherine N. Hayles; narratologist Peter J. Rabinowitz’s four rules of reading; designed guidance of cognitive functions—all framed, continuously confirmed and underpinned by perceptions of Aristotelian, Habermasian, and Lyotardian philosophy.

The model consists of two consecutive stages: the instructor’s and the student’s. Both comprise phases, also consecutively, in which the shifts of hyper and deep attention are induced by the instructor, rigorously enforcing the three Aristotelian pillars of convincing presentation, in the spirit of Nagib Callaos, when he poses the question “Are we providing Higher Education in our universities or just Higher Instruction or, even worst, Higher Instruction in narrow disciplines or sub-disciplines?” (Callaos 2015, 3) In full agreement with Professor Callaos, a related question can be posed in the same context: how far-reaching the consequences of artificial intelligence (which is gaining ground) will be once they will legitimize themselves in teaching? If a human being can become 3.0 from 1.0, will it mean that 2.0 students will become 3.0? The substantial emergence of AI’s informatics dimension can already be felt: electronic learning environments, interactive instruction-informatics, digital pedagogy 2.0 are already here, emphatically, with their positive and negative aspects. We have reached the stage of student 2.0 while cognition as an inexpensable precondition of learning is falling into the background more and more.<sup>5</sup>

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<sup>5</sup> It must be noted at this point that another essential condition of thinking and learning is the high level of reading ability and text comprehension. Susan Greenfield stresses the point when outlining the possible versions of the young generations’ identity scenarios (Greenfield, 2008).

This is why it is particularly important to design teaching models, with the help of which—exploiting (and not ignoring!) all the possibilities that the digital world can offer and forging hyper attention into an instrument—the technological developments of our age, the infinite and multifarious world of the internet can be made to preserve the freedom of cognition, critical thinking, and the human dimension of learning.

Needless to say, if this is the dilemma we have been drifted into, and this is the task we have been assigned at these digital crossroads, interdisciplinary rigor must obtain. And rigor *is* built into the structure of the HY-DE model, a regulation as stage follows stage and phase follows phase; as student attention is guided from hyper toward deep attention in a regulated fashion. One of the rules crucial to this seemingly playful still strictly regulated path (playful in execution but controlled by intent) is that besides the primary goal of this instructional model (aided learning process and efficiency of instruction), its secondary goal must be achieved too. Namely, comprehension, learning, knowledge acquisition, the development of interpretive intelligence are unimaginable without instructional guidance even in an e-world. The Aristotelian Trivium of the human factor is also present in the model with varying degrees of intensity but with interdisciplinary rigor all through.

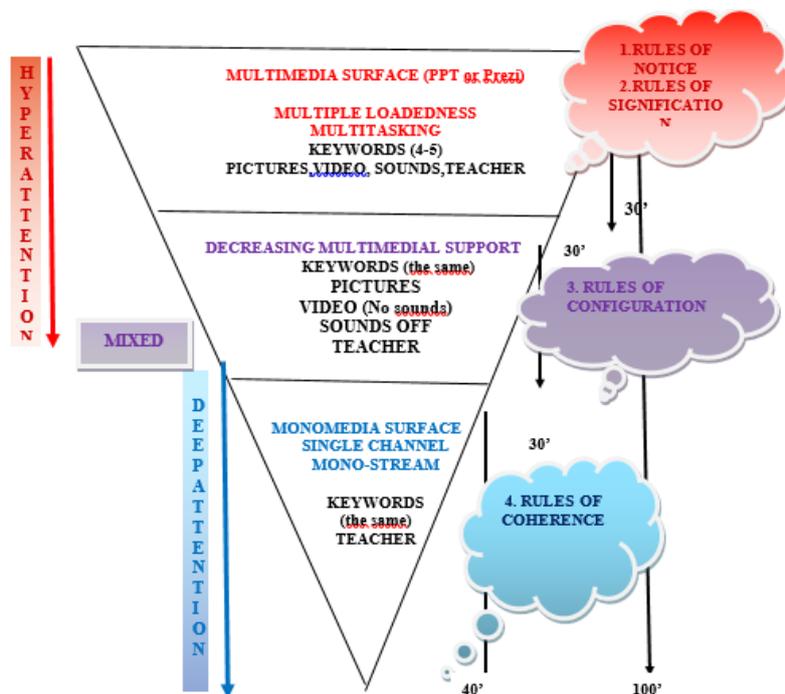
The HY-DE model was constructed for higher-education classroom-teaching situations, to be applied in a consecutive lecture–seminar framework. The 100 minutes of a university double-class-session lecture is the instructor’s stage, consisting of three superimposed phases, the first two being 30 each, the third 40 minutes long.

### **Phase 1 of stage 1**

(Multimedia surface: PPT or Prezi – multiple loadedness, multitasking; using keywords 4-5, relevant pictures, videos, gif-pictures, sounds, and the teacher’s minimal communication)

In the first phase of stage 1 the subject-matter of teaching is introduced on multimedia surface, using a state-of-the-art PPT, or a Prezi presentation. The teacher presents the material in broad outlines. Students do not take notes, they are just viewers and listeners, trying to grasp as much as possible and attribute significance. The digital, auditory, and visual presentation of the subject itself implies multiple interdisciplinarity, in which different disciplines work together, with interdisciplinary communicative rigor; they

enter into a dialogue (cf. Callaos & Horne, 2013). This way the method also heeds the Lyotardian idea of knowledge transformation and the transformation of the nature of knowledge, on the one hand: “[i]t can fit into the new channels, and become operational, only if learning is translated into quantities of information” (Lyotard, 1986, 4). Secondly, it takes advantage of multitasking so characteristic of the bit-generations. Thirdly, there is the element (another component of interdisciplinary rigor) of systematically and strictly harnessing the functions that cognitive psychology describes: the ways in which sensation and perception, attention, thinking, and memory work and the roles they play in the learning process.



**Figure 1:** the instructor’s (first) stage of HY-DE

The guiding principle in this phase is to keep hyperattention alive, by capitalizing on the multifariousness of multimediality. An additional benefit is that the degree of interdisciplinarity is enhanced by the Rabinowitzian rules of reading that also prevail in logical, superimposed gradation. In this phase the rules of notice and signification prevail. Of the Aristotelian Trivium, logical argumentation is foregrounded here through the instructor’s subject words (the PPT slides remain continuously on the screen), and by the teacher inserting explanatory remarks regarding background logical coherence (Logos). Of Salter–Hearn’s elements, knowledge as an instrument is the essential factor here, multimedial presentation being the kind of

information processing which is detectable by hyper attention only, and its processing and comprehension require preliminary knowledge, digital literacy of a kind included. Subject-related multimedial information (image, video, sound) is dumped upon the student, which s/he is able „to process” superficially only. Preliminary knowledge is (also) provided by the succinct, reference-like background information coming from the instructor and what can be called the maintaining rigor of the continuously present subject words.

### **Phase 2 of stage 1**

(Decreasing multimedial support—the same PPT or Prezi—NO multiple loadedness, decreasing multitasking; using same keywords (4-5), relevant pictures, videos without sounds, gif-pictures, and intensifying interpretive teacherly communication regarding the topic)

In the second phase the whole material is re-presented, but multimedial support is reduced step by step. Hyper attention still benefits from visuality, but then the video or other moving images are switched off, then the sound is taken out, and finally the text-slides of the power-point presentation are switched off, until only the teacher’s voice remains. During this phase the students take notes, using traditional techniques of note-taking. It would compel them to start switching to deep attention mode slow but steady.

Knowledge acquisition is still proceeding with the help of computational devices, but a new synthesis of knowledge starts when disciplinary knowledge structures of the first phase are placed into different contexts, which are strictly related to the subject and also identifiable by the students. Cognitive functions move beyond mere perception, and thinking is foregrounded, while keeping the visual and auditory information of the first phase alive in memory becomes more and more important.

Hyper attention alters to mixed attention status; the instructor steps closer to the class emotionally (Pathos); the role of Ethos in knowledge transfer also manifests itself, and Logos is more predominant in teacherly elucidation. In the synthesizing mixed attention phase Rabinowitz’s rules of configuration prevail.

### **Phase 3 of stage 1**

(Monomedial surface—the same PPT or Prezi—single channel, monostream, NO multitasking; using same keywords 4-5, and the teacher's deep interpretation of the topic)

In the third, 40-minute phase multiple loadedness completely disappears, and information monostream (in the teacher's voice) would be foregrounded so as to aid the process of deep-attention activation. During this third presentation of the same material, in-depth discussion of the topic gains priority.

Interdisciplinary rigor can be detected in how hyper attention is transformed, through the transitory phase of mixed attention, to deep attention. The postmodern dimension of knowledge remains, but becomes backgrounded as of the storehouse of digital teaching it is only the consistently applied list of subject words that remains on the screen. Emphasis is laid upon deep thinking about the subject, interrelations and coherence and the Trivium of Ethos–Pathos–Logos with them. Meanwhile instructional logic no longer relies on multimedial components; subject comprehension and acquisition are guided by the rules of coherence. In this phase Rabinowitz's fourth rule of reading (the rule of coherence) prevails.

While what were seen and heard in the first two phases were stored in short-term memory (STM), as a result of the correctly operated model, the subject of teaching will now be stored in long-term memory (LTM), owing to the many repetitions, multiple audiovisual sensations and perceptions, and activated deep attention.

Thinking and reasoning, debating logical aspects will bring Salter–Hearn's critical component into play too, with due consistency and rigor, even if not fully in the sense of their interdisciplinary map. The HY-DE model does lay emphasis upon the critical dimension as critical thinking plays a determining role in the process of learning.

### **Phases 1, 2 and 3 of stage 2**

Stage 2 is the student's. The operation of attention and other factors that bear on the learning process and come from different disciplines is reversed. The student is assigned a concrete task that s/he—in full understanding of the theory—is expected to accomplish, using the learning-by-doing method, setting out from deep attention and gradually reaching the hyper attention

phase. Similarly, Rabinowitz's rules of reading and the postmodern connotations of knowledge will follow each other in reversed order. In the case of the rules of reading, the movement will be from the rules of coherence, through the rules of configuration to the rules of notice and signification. Deep attention will also be reversed into hyper attention. Acquisition of knowledge also moves in the opposite direction. In the postmodern view of interdisciplinarity, transgression of disciplinary boundaries, integration, and fruitful cooperation bear the mark of complexity, nonlinearity and heterogeneity (Klein, 2006).

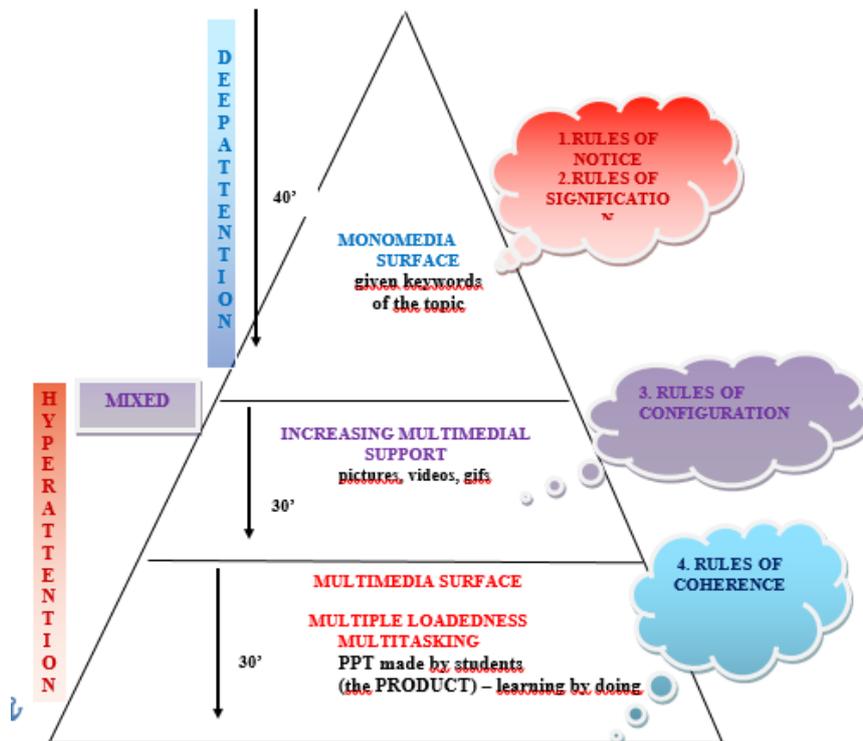


Figure 2: the student's (second) stage of HY-DE

### 3. Translation of the HY-DE model into practice and rating effectiveness—the practical example of a dance-history curriculum

I have translated the model into practice in five curricula, and also used it as an application for data-structure validation in the framework of algorithmic and problem-solving thinking (cf. Csernoch & Dani, 2017). The first curriculum, a trial run at the University of Debrecen, was in a course called „History of the European Union.” I made the details and my experience available at the 6th International Conference on Society and Information Technologies (ICSIT 2015, Orlando, Florida, March 10-13). The other four occurred in the field of teaching the art of dance, where we (in co-authorship

with Anna Mária Bólya) developed—in cooperation with the Hungarian Dance Academy and the Hungarian Academy of Arts—four HY-DE-based materials for teaching four different historical periods of the art of Hungarian ballet and dance. The completed HY-DE-based presentations:

Aurora 3<sup>6</sup> – From the opening of the Hungarian Royal Operahouse through the arrival of Miklós Guerra

Aurora 4 – The art of ballet in Hungary during the creative period of Nicola Guerra

Tradition 5.0 1 – The Hungarian Fullplay,<sup>7</sup> IEC<sup>8</sup> 1938-2021

Tradition 5.0 2 – Folkdance as Stage Art – The Hungarian Folk Dance Ensemble<sup>9</sup>

Dance, an art, based on sound, image, and motion combined, one which can be interpreted as the narrative of visuality, offered our model an optimal opportunity for practical realization. We also developed a method to survey the teaching effectiveness of the model. An application of dynamically developing 3D-spaces is also in the planning, involving the further fields of applied informatics and interactive pedagogy, thereby expanding the dimension of interdisciplinarity (Rácz, Gilanyi, Bólya & Chmielewska 2019)

Of the four dance-art curricula, I am going to introduce only one in a nutshell as an example. These will be four slides: one title-slide and three slides (one for each three teacher's-stage phase). The curriculum teaches the HY-DE-based narrative of the Hungarian State Folk Ensemble, the subject of the first class-session being: shaping folkdance for the stage. The class-session is 90 minutes this time (accommodating the 45 minute class sessions of the Dance Academy). Its three phases are built one on the other in a

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<sup>6</sup> “Aurora” and “Tradition” are names of sponsoring research projects.

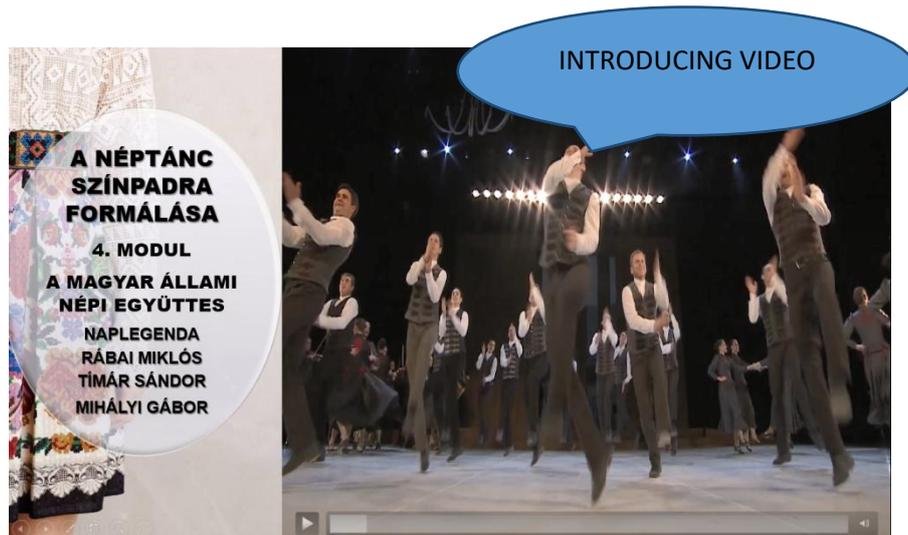
<sup>7</sup> In Hungarian: “Csupajáték” (=fullplay); “The Hungarian Fullplay Production” was an all-art production of 1938-1939.

<sup>8</sup> International Eucharistic Congress

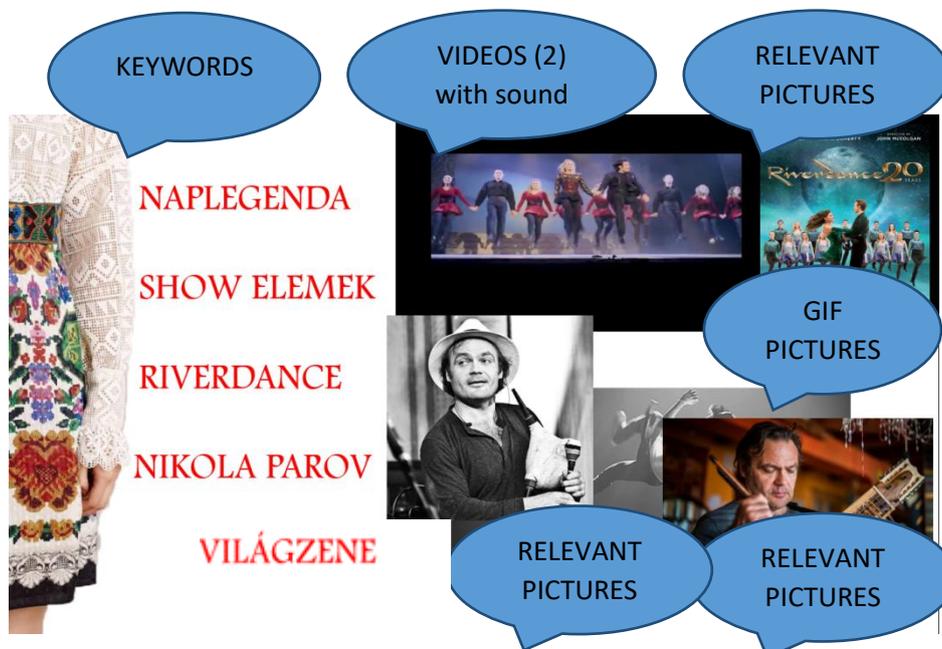
<sup>9</sup> Publications relating to these topics are: 1) Bólya 2020, A romantikus balett Nyugat Európában (The Romantic Ballet in Western Europe); 2) Bólya 2020, Aurora—A magyarországi balett születése: Campilli Frigyes 40 éve Magyarországon—Az első magyar primabalerina és koreográfusnő: Aranyváy Emília (The Birth of Hungarian Ballet: The 40 Years of Frigyes Campilli in Hungary—The First Hungarian Prima Ballerina and Woman Choreographer: Emília Aranyváy); 3) Bólya 2018, Interdiszciplináris kitekintések a táncról: A legfrissebb tudományközi eredmények a táncról egyes társtudományokban (Interdisciplinary Researches in Dance: Recent Interdisciplinary Results concerning Dance in Related Branches of Science); 4) Bólya 2011, The Hungarian Dance Academy: Art Education for Sustainable Development.

progression that moves from informational alternating-current-like multimedial multifariousness (for whose processing hyper attention is needed) towards gradually decreased hyper-attention dominance and increasing deep-attention activity. The latter clearly serving the learning process by the end of the third (the student) stage, by activating the cognitive functions needed for information storage in long term memory.

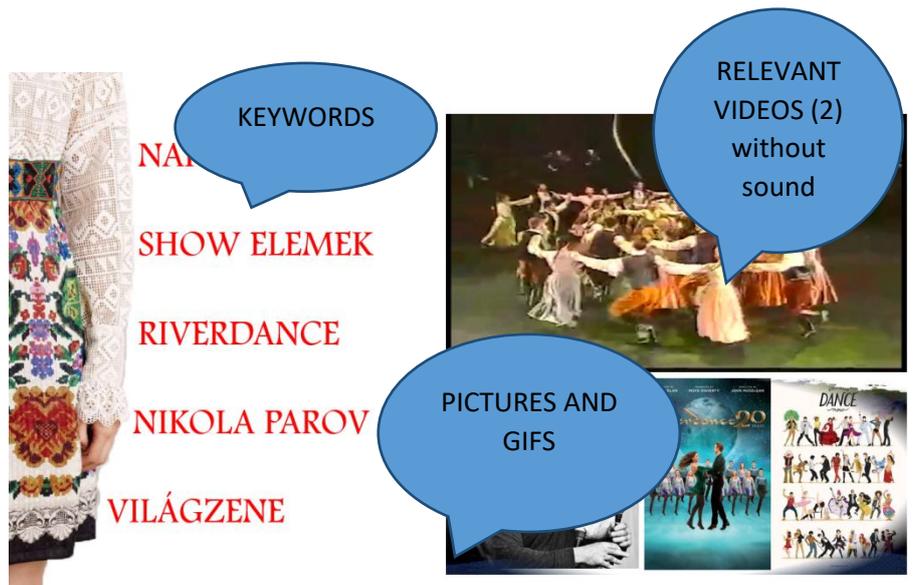
## Slides



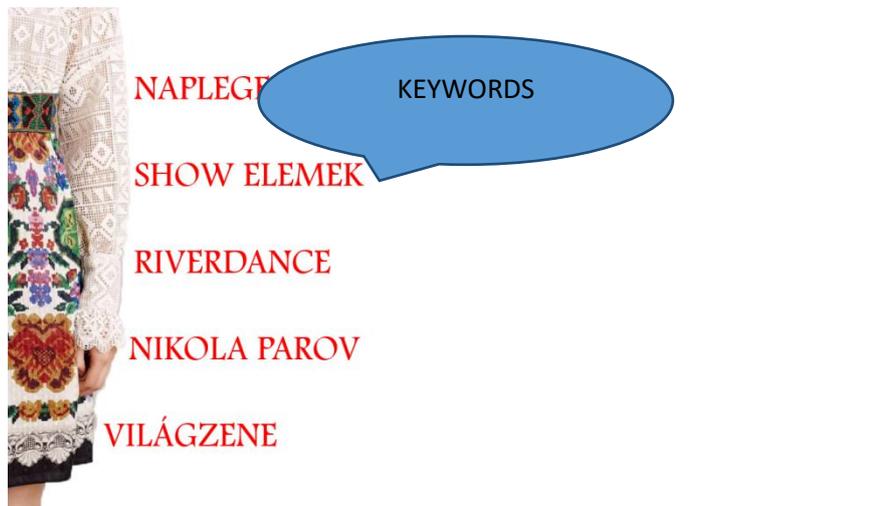
**Figure 3:** title-slide of the presentation



**Figure 4:** first slide of the teacher's stage (phase 1)



**Figure 5:** first slide of the teacher's stage (phase 2)



**Figure 6:** first slide of the teacher's stage (phase 3)

When measuring the efficiency of HY-DE-based curricula, we were primarily interested in the difference the model makes in the different learning styles; to what extent and in what ways its effectiveness depends on those styles, and in which style it is most effective; and, in general, what students think of a given curriculum and the effectiveness of the model in aiding comprehension, memorization, the whole process of learning.

The pedagogical survey was conducted with the consistent rigor of interdisciplinary communication: the 7-factor-related questions of the

learning-style questionnaire strictly asserted (to the relevant extent) the scientific methodology and terminology of cognitive psychology, narratology, philosophy pedagogy, digital pedagogy, reading research, sociology, digital literacy, applied informatics.

Essential features of HY-DE (as indicated in the introduction and in the exposition of the method's philosophy) are: the predominance of visual and auditory elements, constant movement, and the colorfulness of what can be called the "informational alternating current." The hypothesis behind it evolved from the phenomena of bit-generation multitasking and hyper attention that goes with it. It was our intention to adopt the Felder-Solomon questionnaire, for a survey of learning styles with its four dimensions. Eventually, we decided on the Szitó questionnaire with its seven factors: the auditory, the visual, the motional, the collective, silent, impulsive, mechanical).

At the beginning of the semester all students of the two (experimental and control) groups participating in the survey (N: 40) filled in the questionnaire (intended to decide the scale value of auditory, visual, motional, collective, silent, impulsive, and mechanical learning styles). At the end of the semester we applied a surveying instrument of our own designing to see in which of these styles the HY-DE method was most, less, or not at all effective. This latter questionnaire was also based on the 5-grade Likert-scale. No Cronbach-alpha coefficient was counted to test questionnaire reliability since our survey under discussion was meant to be a pilot, and we will certainly refine the closing questionnaire (too) in the light of our present experience as we move on.

The surveys focused expressly on proving or disproving the effectiveness of the HY-DE method, centering the learning styles and the core features stressed in the closing questionnaire: the teacher's lecture, demonstration, presentation; devices that foster understanding of the subject and the interrelationship of these; the way the sea of information (its alternating-current effect), multitasking, and exhaustion relate; the importance of classroom subject-presentation; the demand for the new. Last but not least, the instructor's personal presence, his or her personality features, an important requisite, as effective teaching is unimaginable even in the digital world without the accompaniment of the rhetorical Trivium of Ethos, Pathos, and Logos.

## 4. Conclusion

By way of conclusion, we can say that the HY-DE model can be a model example of the interdisciplinary rigor with which the above requirements can be met.

- The postmodern notions of complexity, nonlinearity, and heterogeneity describe the very nature of the internet. Our model treats information provided by the internet as a digital database since it is the source of multimedial multiplicity so indispensable to feed hyperattention. Internet information search is one of HY-DE's pillars; especially indispensable in the student stage when the learning-by-doing task can be performed with the help of relevant information available on the internet.
- Complexity is one of the principles HY-DE is based on since it is guiding the learning process with the interdisciplinary rigor of the complexity built into its structure.
- Nonlinearity also follows from the use of the internet: the task assigned to the student in the student stage is linear, true, but internet information search may take him/her in nonlinear, heterogeneous directions. It is something that greatly inspires creativity too: HY-DE teaching methodology sets a linear goal, but the road to its accomplishment leads through nonlinearity.
- Heterogeneity goes hand in hand with interdisciplinarity, but the multiplicity offered by the internet has a certain measure of irrelevance from the point of view of any particular assigned subject. It is interdisciplinary rigor that will protect the student from being lost or confused.

All in all the virtual world, visuality, and digital devices can be *only* complementary instruments in information transfer and in the process of effective learning. The sum total of the HY-DE research is *this*, and that the HY-DE model is effective. The partial (because pilot) results achieved so far also encourage instructors, who base some subject-matter of teaching of some curriculum on the model, to further shade off how the components of the model hang together as well as the ways and means in which they relate to each other and work together.

## 5. References

- Aram, J. D. (2004). Concepts of interdisciplinarity: configurations of knowledge and action, Retrieved 12 9, 2020, from <https://journals.sagepub.com/doi/10.1177/0018726704043893>
- Barry, A. & Born, G. & Weszkalnys, G. (2008). Logics of interdisciplinarity, *Economy and Society* Volume 37 Number 1 February 2008, 21, 20–49.
- Bogdán, M. (2004). Az interdiszciplinaritás és a multidiszciplinaritás – Thomas Kuhn evolúciós modellje. Retrieved 8 11, 2020, from <http://communicatio.hu/doktoriprogramok/kommunikacio/belso/projektek/200405/intermultidiszcipl/bogdanm2.htm>
- Bólya, A., M. (2011). *The Hungarian Dance Academy: Art Education for Sustainable Development*. Brussels: European Study Visit (paper 18)
- Bólya A., M. (2018). *Interdiszplináris kitekintések a táncról: A legfrissebb tudományközi eredmények a táncról egyes társtudományokban (Interdisciplinary Researches in Dance: Recent Interdisciplinary Results concerning Dance in Related Branches of Science)*. Budapest: Magyar Táncművészeti Egyetem.
- Bólya, A., M. (2020). *Aurora—A magyarországi balett születése: Campilli Frigyes 40 éve Magyarországon—Az első magyar primabalerina és koreográfusnő: Aranyvály Emília (The Birth of Hungarian Ballet: The 40 Years of Frigyes Campilli in Hungary—The First Hungarian Prima Ballerina and Woman Choreographer: Emília Aranyvály)*. Budapest: MMA MMK
- Bólya, A. M. (2020). A romantikus balett Nyugat Európában (The Romantic Ballet in Western Europe). In: *Auróra – A magyarországi balett születése: Campilli Frigyes 40 év Magyarországon* (ed. Bólya A., M.), Budapest: MMA MMK, 21-28.
- Callaos, N., & Horne, J. (2013). Interdisciplinary Communication, (N. Callaos, Ed.) *Journal of Systemics, Cybernetics, and Informatics*, 11 (9), 23-31.
- Callaos, N. & Marlowe, T. (2020). Interdisciplinary Communication Rigor, Retrieved 10 5, 2020, from [https://www.academia.edu/43648784/RIGOR\\_AND\\_INTER\\_DISCIPLINARY\\_COMMUNICATION](https://www.academia.edu/43648784/RIGOR_AND_INTER_DISCIPLINARY_COMMUNICATION) Intellectual Perspectives from Different Disciplinary and Inter Disciplinary Fields
- Csernoch, M. & Dani, E. (2017). Data-structure validator: an application of the HY-DE model. . In: *Proceedings of the 10th IEEE International Conference on Cognitive Infocommunications : CogInfoCom 2019* (ed. Baranyi, P.). Piscataway (NJ) : IEEE, 197-202.
- Choi, B. C. K. & Pak, A. W. P. (2006). Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness, *Clinical and Investigative Medicine*, 29: 351–364. Retrieved 5 11, 2020, from [https://journals.sagepub.com/doi/pdf/10.1177/0018726704043893?casa\\_token=CV82vs3QzUUAAAAA:hsGr6ARp288WTDL0Aomci-yhTbSylacwLN\\_nyqVj3zNLyDeWX3ccDM6RDPcfobXwvZAammuTvGYEMA](https://journals.sagepub.com/doi/pdf/10.1177/0018726704043893?casa_token=CV82vs3QzUUAAAAA:hsGr6ARp288WTDL0Aomci-yhTbSylacwLN_nyqVj3zNLyDeWX3ccDM6RDPcfobXwvZAammuTvGYEMA)
- Dani, E. (2015). The HY-DE Model: An Interdisciplinary Attempt to Deal with the Phenomenon of Hyperattention. *Journal of Systemics, Informatics and Cybernetics*, 2015, 13, 6 Retrieved 5 11, 2020, from <https://core.ac.uk/download/pdf/161039396.pdf>
- Felder, R. M. & Soloman, B. A. (1996). *Index of Learning Styles Questionnaire*. Retrieved 10 1, 2020, from <https://www.webtools.ncsu.edu/learningstyles/>
- Greenfield, S. (2008). *ID: The Quest for Meaning in the 21st Century*. London: Sceptre.
- Hayles, K. N. (2009). *Hyper and Deep Attention: The Generational Divide in Cognitive Modes*. Retrieved 12 6, 2020, from <https://www.jstor.org/stable/25595866?seq=1>.
- Klein, J. T. (2006). A Platform for a Shared Discourse of Interdisciplinary Education, *JSSE – Journal of Social Science Education* 2006. Vol. 5(1). 10–18.
- Lattuca, L.R. (2001). *Creating interdisciplinary: Interdisciplinary research and teaching among college and university faculty*. Nashville, TN: Vanderbilt University Press.
- Liotard, J.-F. (1986). *The Postmodern Condition: A Report on Knowledge*, Minneapolis: University Of Minnesota Press.
- Rabinowitz, P. J. (1998). *Before Reading: Narrative Conventions and the Politics of Interpretation*. Columbus, OH: Ohio State University Press.
- Rácz, A. & Gilányi, A. & Bólya, A. M. & Chmielewska, K. (2019). A Virtual Exhibition on the History of Hungarian Ballet. In: *Proceedings of the 10th IEEE International Conference on*

*Cognitive Infocommunications : CogInfoCom 2019* (ed. Baranyi, P.). Piscataway (NJ) : IEEE, 431-432.

Szitó, I. (1987) A tanulási stratégiák fejlesztése, *Iskolapszichológiai füzetek*, 2 .sz. Retrieved 28 11, 2020, from <http://matekedzo.hu/wp-content/uploads/2016/11/tanul%C3%A1st%C3%ADlusok.pdf>