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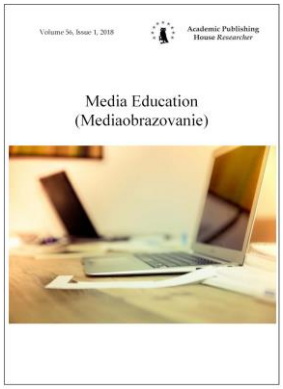

Cognitive Analysis in the Context of Media Education: An Oriented Graph Modeling Approach

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Abstract

Cognitive analytics could initiate development processes in media culture and media education in Russia. Cognitive analytic models in the context of media education appear to be organizational schemass for managing people's cognitive activity. They are an abstract model of search, receiving and processing of media-information. Cognitive models form an image of cognition process thus allowing to visually explain a comprehend structure of interactions and interlinks. Theories of cognitive development by Piaget and cognitive perception form theoretical framework of the given research. In order to formalize structures of cognition, a method of oriented graph is adopted. Learning model based on double loop by Argyris and Schoen forms the basis of analytical research. We consider to what extent it is applicable to the analysis of cultural dialogue and media education theory as a trigger for developing critical thinking. We suggest and study cognitive models of media education with the growth accelerators. We outline solutions for increasing the media education efficiency and highlight that cognitive analytics applications are not limited to revealing critical aspects of media education only. Instead, it contributes to widening common view of management strategy. Cognitive models thus can potentially replace conceptual and instrumental means of group interaction and active opinion exchange for elaborating consolidative positions.

Keywords: media education, cognitive analytics, structural approach, graph theory, models

1. Introduction

In the contemporary societies, images of social communication gradually dominate over non-visual and intellectual information (Stompka, 2007). Moreover, visual constructs not only include powerful channels of information perception but also initiate interpretation of communicated images. However, a culture that exists behind understanding of an image, and, moreover, media image, is not sufficient (Fedorov, 2014). As widely known, any visualization is based on visual comparison of the studied substances, in other words, it refers to the metaphorical representation of objects (Averbukh, 2005). Proceeding from this, a culture behind the understanding of an image is inevitably linked to the cognitive abilities, and above all, an ability to understand a communicated sense together with its metaphorical meaning (Kovaleva, 2017). In this context, it appears reasonable to define media culture as a system of signs with own language, codes to

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communicate reality, maintaining a number of social functions, especially an educational one. In turn, it sets the requirements to invent and develop methodical means to represent, analyze, and interpret visual information (Kirillova, 2006).

Amid different tools to formalize non-visual and intellectual descriptions, cognitive models based on the mathematical graphs are the major ones. Being heuristic visual structures, cognitive models give a schematic and simplified description of the phenomena perceived by an actor in society. Observing an object, an individuum forms in consciousness its particular image, which is nothing but a cognitive model. It is also theorized that an actor has some kind of repertoire, a set of cognitive models to analyze causes of social events, analogous to the McLuhan's method of perception by instances (stereotypes) (McLuhan, 1962). Thus, a cognitive model supplies an actor (researcher, expert, individuum) with a schematic illustration of his ideas regarding a system of links (relations, influences, interactions) between concepts (objects, substances, factors) created in the process of cognition (Fedorov, 2015; Svechkarev, 2017) states that media education refers both to a cognition of creation and distribution of media texts, as well as to a development of analytical skills to work out and interpret their content. We thus assume that cognitive analytics enhances the development of media culture and media education in Russia. Hence, the purpose of our research is to form and apply instruments of cognitive analytics to the context of the media culture and media education in the today's Russia.

2. Materials and Methods

Structural approach to analysis of social communication processes forms the theoretical basis of this study allowing us to outline all the elements of the constant system and links between them. Furthermore, this structure can be described at the various levels of decomposition. A mere representation of this structure relates to a topological description based on the mathematical graphs theory, when the links between elements of a system can be determined at the level of constants (concepts). In the given study, we employ a cognitive model denoted in the graph theory as an oriented graph (Roberts, 1976). The research is carried out within the theoretical framework of the cognitive social analytics (Starostin, 2014). In the application to media education, this framework is to be interpreted as an approach of a critical thinking development (Masterman, 2000) or cultural dialog based on reflection and evaluation of the media text (Fedorov, 2015). The chosen methods contribute to overcome the human rationality limitations, and, most importantly, allow for tackling a problem (or proposed decision) at the group level, where exchange of opinions and debates take place to work out a consolidated position (Katalevsky, 2011).

3. Discussion

The development of the media education system, on the one hand, initiates the requirement to come up with the analytic paradigms at all research levels and domains. On the other hand, it actualizes the requirement to elaborate new methods for analysis of educational processes. With these regards, existed theoretical frameworks, as well as applied analytical instruments, need to be revised (Zinchenko et al., 2015), distinct approaches are to find their application to a new area of the research where education is strongly linked to cognition and media. In this context, J. Piaget's theory of cognitive development (Piaget, 1994) and U. Neisser's insight on cognitive perception (Neisser, 1976) are amid those potentially new for educational research approaches that provide valuable heuristic schemas for tackling issues of cognition in media education.

To describe an information absorbing process, Piaget proposes to use concepts of schema and operation. The schema helps to structure information regarding the main features of the cognizable object, whereas operation determines a character of schematic interpretation in the process of cognition. A set of schemas adopted by an actor to comprehend new information changes in the result of interaction with the cognizable object. Both variety and quality of cognitive schemas, together with an actor's ability to adapt them in accordance with the features of a cognizable object, in the end, determine the efficiency of receiving new knowledge. The more accurate this adaptation of schemas to the features of an object is, the deeper a cognitive process is.

U. Neisser comes to a similar conclusion adding that an actor always modifies cognitive schemas in the process of cognition. However, the scholar finds out another peculiarity in the application of cognitive schemas by an actor: schemas set plans and goals for managing cognitive activity and appeal to be an anticipation model of all human search, receiving, processing and

summarizing of any information, which in turn leads to somewhat entitled by the scholar as a perceptual cycle (Figure 1).

In this cycle, a *Cognitive map,* or *Schema of Actual Environment,* directs perceptual activities *(Actions (Perceptual investigation))* in accordance with *Potentially available information* or concrete *Given Information*. Continuous initiation of perceptual activity on the basis of anticipated schemas or processing information and constant modification of these schemas in the course of receiving new information causes the development of perception and cognition per se. Worth noticing that we in this light deal with two cycles: in the first, the *Cognitive Map* initiates *Actions* based on the *Potentially Available Information* thus setting anticipations of perceptual activities. In the second cycle, the feedback is realized to provide an adjustment ("self-setting") of a specific *Schema of Actual Environment* based on *Given Information* and triggering a particular *Perceptual Investigation*.

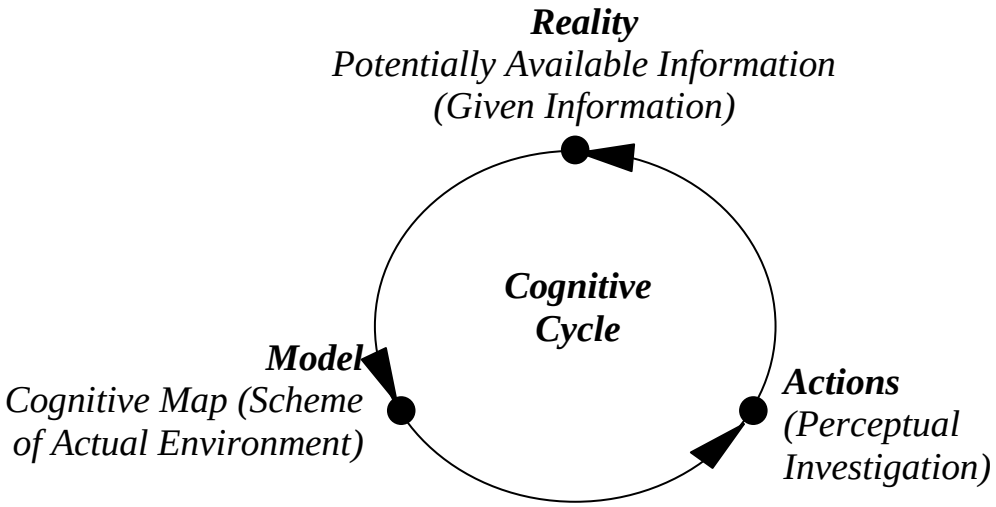

Fig. 1. Structure of perceptual cycle (Neisser, 1976)

Every aforementioned cycle includes an incorporated cognitive model (a *Cognitive Map* in the first case and *Schema of Actual Environment* in the second) and in the end forms a so-called single-loop learning (Kolb, 1984). In Kolb's model, single loop learning accentuates detection and correction of errors, learning focuses on gaining information for maintaining and stabilizing existing systems and aims to produce immediate solutions to relevant problems (Akela, 2010). The principle of the loop is essential here since it drives a cycle of continuous learning.

Later on, two processes, namely, anticipation and self-setting, previously described in the Neisser's model, were united in the more advanced model of a double loop learning by (Argyris, Schon, 1996) (see Figure 2).

The main circle reproduces permanent learning based on perception, cognition, and action (by (Kolb, 1984)), whereas the supplementary one incorporates different models in the learning process. Information about the real world both affects actions (procedures of cognition) and changes mental models of subjects of cognition. Self-organization of mental models leads to change in the model of actions and further directs actions thus correcting the process of learning. Variation of mental models ensures efficiency of the learning process with regards to any specific reality, allows for adopting new educational strategies, especially in the field of media education.

This approach was further developed within the framework of professional education. Analogous to the considered models, systems of professional education used a double loop learning approach. They are however different by organizing a cycle of "positive" loop that enhances effects of the factors included in the model. Achi et al. (Achi et al., 1995) suggest denoting the given schema as a growth cycle, whereas the factors determining enforced efficiency are described by the concept of growth accelerators. In order to draw an image of the educational cycle with a positive reinforcing loop as a cognitive model, one should use oriented graph. In this case, the model shows a diagram of causal inference where links between factors are visible.

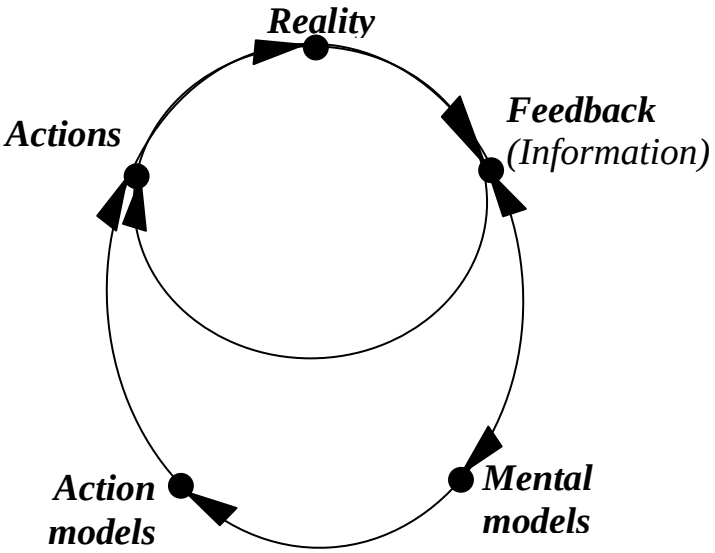

Fig. 2. A Double Loop Learning Model (Argyris, Schon, 1996)

For instance, (Grimmer, 2015) also indicated enforcement of causal inference in social analytics. In this case, causal relations in diagram form cycle, i.e., directed sequence of factors, where all factors are different except the first and last one. If a change in any factor of the cycle, in the end, stimulates a self-change in the original direction, a cycle under this condition is defined as a positive loop cycle and denoted with the sign (+) (Katalevsky, 2011). The examples of this self-transformation can be observed within the process of self-regulating learning, when all the procedures of cognition, motivation, and behavior align in accordance with objectives, results of analysis and contextual features of the educational environment (De Stasio, Di Chiacchio, 2015).

4. Results

We consider the application of educational cycles based on the positive double loop in the context of cultural dialogue. The last, in its turn, is based on cognition, analysis, and evaluation of media text (Fedorov, 2015). The basic positive double loops function in accordance with aforementioned Naisser's model of the perceptual cycle (Figure 1). In the process of analysis, we suggest adding factors and links that create a supplementary circle with a positive loop. Thus, a growth accelerator is to be included in the educational growth cycle, which is formed by one or more positive loops.

For describing the basic learning process, we use a cycle model with the positive loop similar to that of Naisser's perceptual cycle (Neisser, 1976) (Figure 1). During the analysis, we add into the model different factors and links that form supplementary cycle of a positive loop. Thus, the growth accelerator is included into the cycle of educational growth which is formed by a single or double positive loop. The cognitive model of media education with the growth accelerator is shown in Figure 3.

Four main factors form a basic cycle of media education and these are *Tasks, Interactions, Reaction, Evaluation*. Analogous to Naisser's model, in this case, factor *Tasks (Models of Action)* appears to be a plan to realize media procedures, a to-do-model for information search and receiving. Change in the meaning of any factor (increase or decrease) will affect in the same way the cycle of positive learning loop. All in all, that is how a structure of active and continuously initiated learning cycle looks like. As such, an increase of tasks in the light of *Models of Action* will inevitably lead to accumulation of *Interaction*, i.e., additional media procedures will take place. As a consequence, *Media Environment* will enhance reactions to learning procedures, that in its turn will trigger the growth of the communicated educational information as a result of evaluation of reactions within the media environment. Finally, new additional information will stimulate self-transformation of a *Tasks* factor, which means that a new cycle of cognition is thus to be initiated.

It should be noted that the model described above can potentially reduce volume and quality of educational *Information* due to a positive loop, sequentially decreasing the meaning of all factors until *Reaction*. This situation is likely to end up by inefficiency, attenuation of the educational process. Implementation of cycles with growth accelerators is a possible solution to avoid this problem.

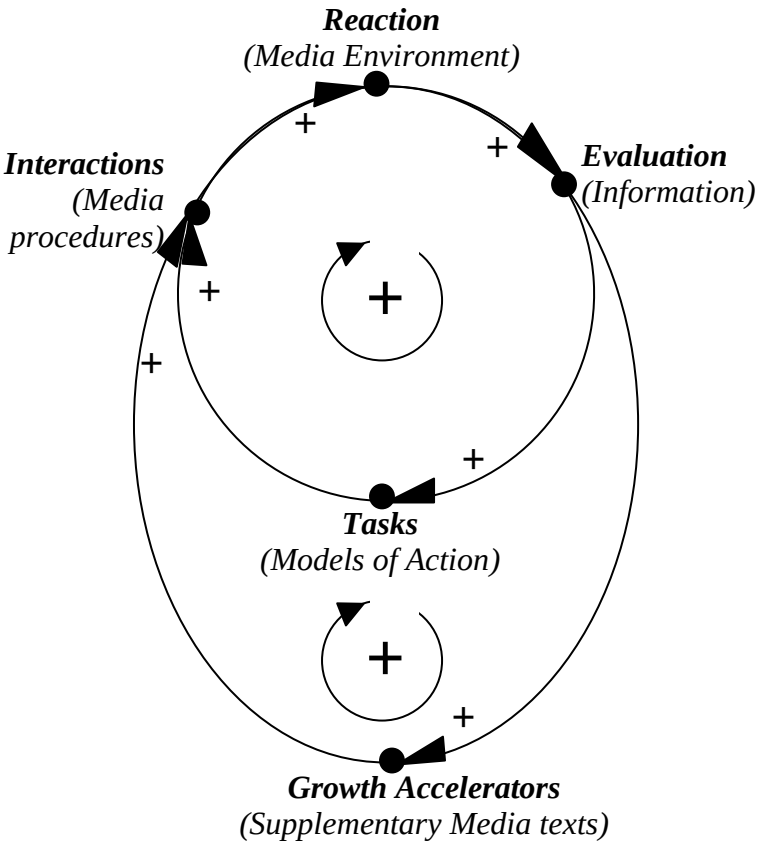

Fig. 3. A cognitive model of media education with growth accelerator for interaction.

In the model (Figure 3), the *Growth Accelerator* is represented; due to its presence, additional growth cycle for such factors as *Interaction, Reaction, Evaluation* takes place. It is also assumed that inclusion of complementary media texts unrelated to the *Tasks* but developing communicative and creative skills of a student will enhance learning process and interaction with media environment. Thus, the attenuation of the learning process in the basic cycle is avoided.

Consequently, a growth accelerator becomes itself an essential element in the strategic management of the education and learning processes. Moreover, a combination of the circle including the growth accelerator with the basic circle ensures the strongest effect and results in a synergy of growth.

For the organization of continuous media education cycle, one requires to create a combination of few positive loops. As every positive loop is self-enhancing by its nature, multiple loops substantially increase each other's effect. This synergic effect of positive learning loops leads to the continuous generation of improvement factor *Interactions*; it takes place through the variation of media procedures using the resources of the internet, computer animation, interactive games for developing critical thinking, creative and communicative capabilities.

One finds the second important aspect of appealing to the cognitive analytics in the media education context as the means to develop the critical thinking (Masterman, 2000). As such, considering the main objectives of media education, L. Masterman postulates that a strong requirement exists to teach the audience to analyze critically and resist manipulation in mass media. This statement corresponds to that of Fedorov (Fedorov, 2008) who also accentuated a distinctive role of the critical analysis in the stand against media violence and emotional contagion

in social media (Kramer et al., 2014). Specifically, A. Fedorov indicates that media violence contributes to social criminalization (although the main reasons behind violence are of socio-psychological, not media, nature). Needless to say, aggressive media narrations traumatize fragile psyche of children that in its turn results in fear, anxiousness, deprivation or stuttering. According to Fedorov's data, 80 % of the survey respondents expressed the requirement to elaborate more strict criteria for age rating to limit the impact of the violence on screen and in other media on children.

Consider the positive double loop learning model that describes a case where superpositions of disturbances (influence of media incidents) of a different kind on the media environment where the educational process takes place (Figure 4). Analogous to the model in Figure 3, four main factors form a basic cycle: *Tasks, Interactions, Reaction, Evaluation*. The basic cycle of the model is built based on educational *Setting*, described as a *Reference Model*. In this case, a signal from the *Setting* factor continuously initiates *Task,* whereas characteristics of *Model of Actions* follow the requirements of a *Reference model*. This, in turn, ensures the formation of *Media Procedures* and receiving of the expected *Media Environment* reaction as well as *Information*. The letter further stimulates a change of the *Tasks* factor in the original direction thus triggering the new cycle of cognition.

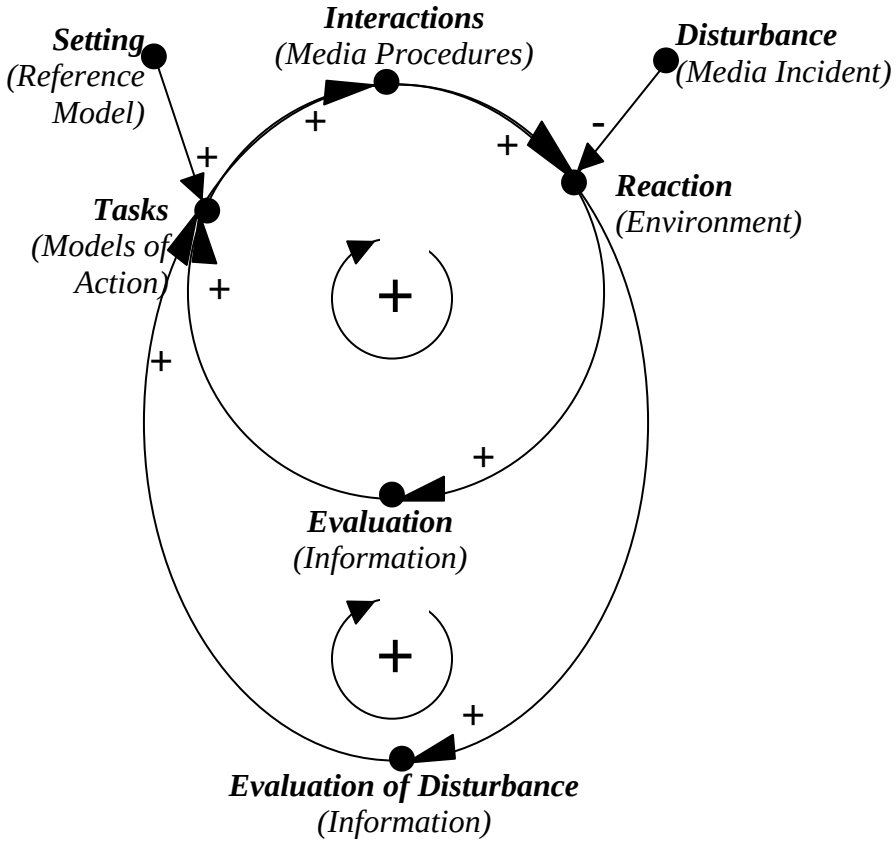

Fig. 4. Cognitive Model of the Media Education with Evaluation of Disturbance

However, an organized educational cycle is not efficient if *Disturbances* affect *Media Environment* by bringing up destructive, manipulative or aggressive media incidents that reduce direction of reactions on learning procedures. As a chain reaction, it will result in decrease of volume and quality of educational I*nformation,* number of *Tasks* and attenuation of the educational process. These problems are efficiently modelled by the organization of the second circle (see Figure 4), which such factor as Evaluation of Disturbances (receiving of information regarding Media Incidents). The circle allows for revealing media Incidents timely and based on these evaluations purposefully transform the model characteristics prior to start of an educational cycle. In this case, media procedures while interacting with media environment will account for

disturbances and consequently block effects of specific incidents on the learning process. The higher an evaluation of disturbances is, the more efficient is a counteraction.

The analytical arsenal or a researcher is not limited to the outlined cognitive models only. However, even the description of data sufficiently confirms that cognitive models with the applications of the oriented graph approach are a powerful tool for studying media education processes in the today's Russia.

5. Conclusion

1. Cognitive analytical models in the context of media education are self-organizing schemas for managing a cognitive activity, summarizing anticipated models of search, reception, and procession of media information. Being highly abstract, cognitive analytical models aim to draw a visual representation of the cognitive process that helps to simplify and explain a comprehensive system of cognized effects of dependence and interactions.

2. Pedagogues, students, analysts and researchers of media education have an opportunity of using in their research practice those analytic models that showed their best in other related academic areas. An example of this model is a double-loop learning model that can enrich perspective on media education.

3. Analysis of the media education processes revealed that positive double-loop models based on growth accelerators prove their efficiency on practice. For instance, growth accelerators for enhancing interactions with complementary media texts that develop communicative or creative capabilities of students. Invention of the model with multiple growth cycles allows for receiving ongoing cycle where different loops increase each other's effect. This solution ensures effective learning within the media education process for a long time.

4. A number of the media education areas such as distant learning or self-learning via TV, radio or other media assumes active presence of media critics. In such situations, it is reasonable to conduct analysis using educational model based on the positive double-loops that describe superposition of disturbances (influence of media incidents) of different type on media environment where the learning process takes place. For instance, critical analytics incorporated into learning process allows for accentuating a negative attitude towards violent behavior and as an alternative to it, find out another, non-destructive solutions.

5. Consequently, cognitive analytics aims not only at illuminating of critical points in the process of media education but also contributes to elaboration of common view of management strategy, forms efficient media procedures applicable to specific media environments. Cognitive models thus can potentially replace conceptual and instrumental means of group interaction and active opinion exchange for elaborating consolidative positions.

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