

Academic Discourse and its Implications for Higher Education: Students' Cognitive Flexibility Development and its Backward Input in Academic Discourse Development

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Abstract: this paper is aimed at the Cognitive Flexibility analysis as a component of Sophisticated Thinking and possible prospects for its enhancement through both teachers' and students' academic activities. To test potential input of academic activities in cognitive flexibility development a special study was conducted. Throughout extra English classes with 5-month duration participants of the study (156 students in general) discussed research papers of their lectures as topics for the discussion. The papers were devoted to the students themselves as a part of the educational content interpreting and clarifying on the issues being of high interest among the youth. Thus, processing the papers supposed simultaneous students' involvement into academic activities. Prior to the experiment sessions and after, all participants were encouraged to pass Stroop Colour Word Test and Free association test to measure their current level of Cognitive Flexibility. After the last session on papers' discussion the students were simultaneously asked to perform Self-Reported Questionnaire. Both of the monitoring instruments are meant to verify each other to reveal and evaluate ongoing and subsequent levels of students' Cognitive Flexibility (degree of being categorical/rigid or lenient). This was measured by means of clarifying on the skills regarding utilization of elicited cause-and-effect connections; perceiving ability to be involved in teamwork; encouraging interest to new approaches of the renowned agenda; refusing from non-reversible reasoning; changing attitude to academic activities. The authors put forward the hypothesis suggesting a deliberate choice of the participants: as first and second-year students have vague motivation and relatively low level of Emotional Intelligence, they may have lowered Cognitive Flexibility. Still, five and six-year students are able to demonstrate far more developed skills mostly based on their working experience that supposes involvement into working atmosphere, thus contributing to enhanced Cognitive flexibility and less rigidity. Surprisingly, the results obtained through Self-Reported Questionnaires demonstrated the impressive rise in the participants Cognitive Flexibility level immediately after the third study session. The aforesaid witnesses that such activities allow research papers to be more practically-oriented, that, in its turn, inevitably increases their validity and further incorporation in formation of modern educational design.

Keywords: academic discourse, cognitive flexibility, higher education, sophisticated thinking.

Introduction

Currently Russia is deeply involved in international educational policies of European countries. Topical political trends have a direct impact on the formation of educational environment for modern training of highly qualified specialists in undergraduate, graduate and post-graduate programs. Along with the formation of a unified educational system, there is a scientific space integration – process implemented through consolidated efforts of all countries.

These facts necessitate a development of scientific research competence of teachers as a part of their professional portfolio within modern educational landscape. Still, university research activities should not be unidirectional. Joint involvement of teachers and students will predetermine multitasking of educational communication, which, in turn, will promote and enhance cognitive flexibility, in parallel with a change in the nature of the following interaction chain: teacher-students, students-students (teamworking, mutual respect, new approach to research activities). On top of that, these activities will clearly make students think and analyze rather than assign someone else's point of view, subsequently creating prerequisites for enhancement of Sophisticated Thinking. These all inevitably demand active students' engagement in universities' research activities, and the issue about validity of scientific research based on empirical rather than theoretical study arises. Moreover, postindustrial stage of modern society development introduces new requirements to educational system aimed at full renovation of educational design landscape as mere incorporation of new educational elements into existing educational system cannot fit the demands of nanotechnological industry. It is self-evident that such renovation is impossible without intensifying both teachers and students' research activities.

Thus, reality disposes Complex Problem Solving; Critical Thinking; Creativity; People Management; Coordinating with Others; Emotional Intelligence; Judgement and Decision Making; Service Orientation; Negotiation; Cognitive Flexibility as key criteria to professional competencies of future specialist (Tikhonova, Kudinova, 2016). The authors of the paper believe that Sophisticated Thinking (ST) incorporating such constituents as Critical Thinking, Cognitive Flexibility, Complex Problem Solving, Creativity and Emotional Intelligence can be one of the responses suggested in novel conditions to be appealing to academic community and university youth. The problematic issue about modern university youth lies in their unwillingness and inability to process information and make thorough decisions on its basis. As a matter of fact, students substitute their own thinking and generate ideas with authoritative and approved statements which, in its turn, is explained with underdevelopment of Lower Order Thinking Skills and evident preference towards Higher Order Thinking Skills that are not able to benefit without proper acquisition of Lower Order Thinking Skills (Tikhonova, Kudinova, 2015).

When an individual accomplishes a complex assignment one's behavior needs adjusting to the surrounding circumstances in which the task is being implemented. Still, these circumstances persist to alter as the assignment extends, consequently in order to be flexible an individual has to consider these conditions on a recurrent basis. On the one hand, cognitive flexibility vitally hinges on consideration processes, e.g. to be cognitively flexible, an individual needs to distinguish the surrounding conditions that could intermeddle with an ongoing assignment. Conversely, cognitive flexibility is also applied to the way people introduce their knowledge about an assignment and the feasible schemes in which to interact with. Human actions are managed by an individual's knowledge with reference to the values of the environmental criteria. This knowledge has been acquired through the use of adopting previous comparable situations. Still, this knowledge has to be revised when the scenario changes in order to redefine possible updated task demands/requirements. It results in Cognitive Flexibility Theory interpretation which states that people who represent the task from complex perspectives can freely expound situational shifts in the surroundings and, therefore, can be more cognitively flexible. So, these individuals have flair for rapid restructuring their knowledge hence adjusting their replies to drastically transforming situational requirements.

J.P. Guilford (1967), being a pioneer in acknowledging *cognitive flexibility (CF)* in early prototypes of creativity and intelligence studies, set off a flow of a profound interest towards the phenomenon. Currently, CF is considered to be a distinguishing feature of human cognition and intelligent behavior (Boroditsky, Neville, 2010; Deak, 2003; Jordan, Morton, 2008). There are various behaviors that are viewed and regarded as flexible (e.g., Complex Problem Solving; Critical Thinking; Judgment and Decision Making;), accordingly, cognitive flexibility can be inferred in numerous ways. Some interpret it as a unique cognitive ability or skill (Aron, 2008; Smith, Kosslyn, 2014) while others consider it to be a feature of different cognitive processes (Blaye, Bonthoux, 2001; Plunkett, 2005).

To scrutinize cognitive flexibility as a specific, unique ability, it is crucial to revise "shifting" being understood as a person's ability to promptly adapt from one judgement, requirement, or assignment to another while giving a feedback. This generalized statement is solidly underpinned by the view of H.M. Geurts (2009) who outlined that "one component of executive function is cognitive flexibility, which refers to the ability to shift to different thoughts or actions depending on situational demands", and A. Diamond (2006) who declared that "cognitive flexibility ... is the ability to flexibly switch perspectives, focus of attention, or response mapping". Regarding CF within the task-switching paradigm (Vandierendonck, Liefoghe, 2010) it is necessary to highlight the aspect whether shifting is the same phenomenon as CF or is a mere tool involved in CF.

An opposite approach has been introduced by researchers (Barsalou, 1983; Barsalou, 2003; Shafto, Coley, 2007; Sloutsky, Fischer, 2008) who analyze cognitive flexibility as a property of various cognitive processes (e.g., flexible categorisation, flexible language use, flexible feedback in induction tasks). In all this research array, the key idea is that flexibility arises to be a property of the examined process. Thus, providing no distinctive definitions they only witness that the examined process is flexible and causes flexible feedback, simultaneously analysing the outward conditions that stimulate the flexibility occurrence (e.g., stimuli, assignment requirements, related experience).

Contemplating those viewpoints, we believe that the concept of CF is a "unified framework that conceptualizes cognitive flexibility as a property of the cognitive system" (Ionescu, 2012, 194). On the

one hand, there are the mechanisms and processes of the cognitive system (e.g., shifting, memory, categorization); on the other, there are the cognitive system's properties (e.g., prospectivity, reproductivity) (Ionescu, 2012, 194).

The research goal is to prove that as a part of Sophisticated Thinking, a more developed Cognitive Flexibility will significantly contribute to its enhancement.

Methodology

The research goal is to prove that as a part of Sophisticated Thinking, a more developed Cognitive Flexibility will significantly contribute to its enhancement. The authors set a goal to demonstrate that Cognitive Flexibility is in its turn strongly promoted by profound research activities, because it does not allow to assign someone else's point of view, being initially aimed at producing new and different skills.

The research goals determine its objectives, namely: development of students' conscious motivation for engagement in research activities; demonstration of the fact that research linked with education is not totally disconnected with reality, and each student's position can influence its possible results; postulation of the statement that teachers' academic activities are far more effective being aimed at educational interaction improvement; and, finally, presentation of the evidence that CF is teachable and there is an essential necessity to familiarize students with academic tools.

As modern university youth demonstrates self-centred positioning that exudes their own interests and key priorities within the educational process, there is a crucial need to introduce something brand new to get students interested. Researchers who work as teachers can substantially improve the educational landscape and approaches to its organization in those groups where they teach. So, they change the students' attitude to education, science, developing their CF through enhancement of team working skills, negotiating, flexibility in categorization, language use, and responses. All these capacities are considerably improved in the process of research activities.

As a consequence, the core hypothesis of this paper is explicable: in striving to foster cognitive flexibility for its further use in enhancing academic discourse skills, whether it is possible to connect the notion of CF as shifting with the notion of being a flexible solver, who has awareness of multitasking and the ability to generate new strategies. And if this "connection" is able to activate two-tier process which enhances students' teamwork and students' autonomy through academic discourse development. This study addressed one hypothesis according to which first and second-year students have uncertain motivation, relatively low level of Emotional Intelligence and Cognitive Flexibility while five and six-year students are able to show far more extensive skills. Being involved into working atmosphere they have to be less rigid, more multitask-oriented and more opened for new ideas and their analysis.

Participants. Participants of the study (156 students in general: 80 first and second-year students at C1 English level at Plekhanov Russian University of Economics, and 76 - five and six-year students at RUDN University of Russia) were informed about the purpose and the essence of the study and voluntarily took part in it. The age of the participants extended from 17 to 26 years. Regarding race / ethnicity, 75 % recognized themselves as Russians, 9 % as Africans, 5,5 % as Tatars, 4,5 % as Armenians, 3 % as Ukrainians, 3 % as Others.

Methods. The computerized method of Stroop Colour Word Effect (SCWE) was used to test the current level of the selective attention and cognitive flexibility of the participants, presentation of stimuli (one at a time) that enables a more precise measurement of reaction time (RT) for individual trials.

Originally Stroop included three components in his test. First, the individual was invited to label a set of colored words (Word task). Second, the individual labeled the bar color (Color task) of X's (e.g., XXX in red, blue, or green ink). The Color-Word task during which the individual was demonstrated the colors names printed in unmatched ink colors (e.g., the word "red" in green ink) and was invited to label the ink color rather than the word itself came the third.

The Stroop interference effect refers to the increase in reaction latency observed when an individual is required to identify the color of a color-word when these aspects of the stimulus are incongruent (e.g., the word red presented in the color blue) compared to the time required to name the color of a neutral (e.g., XXX in blue, or congruent, e.g., the word red presented in the color red) stimulus. The conflict between the relevant (color of the word) and irrelevant (name of the word) dimensions of the

stimulus on incongruent trials presents a particularly difficult task for the selective attentional system. A system that efficiently suppresses the irrelevant dimension (i.e., the word) should exhibit faster color naming than a system in which impaired suppression of the word dimension allows greater competition between the word name and the color name for response output (Raveendranadh, Mur, 2013). The underlying cognitive mechanism involved in SCWE is named selective or directed attention, as the participant has to manage attention, resist interference from irrelevant stimuli, inhibit or stop one response in order to express or do something else. Herefrom, as we suppose, the ratio of change in the reaction time of each participant to identify the color can reflect the presence/absence of alteration in the level of cognitive flexibility development of the study participants. Reaction time of each participant to identify the color of each word can perform as this criterion as well. Presentation of stimuli (one at a time) enables a more precise measurement of reaction time for individual trials through elapsed time on reading aloud. Referred indicators were recorded using computerized version of the Stroop Color Word Test (SCWT) including 40 coloured words.

Concept analysis through Free association test (FAT) was applied to verify SCWT. The concept being a basic cultural cell in the mental world of a person fixes on the meaning of a sign (word, phrase, term, lexico-grammatical structure, action). As a linguistic-cognitive phenomenon it is viewed as the information about a person's knowledge, suggestions, thoughts, images about the objects of the world. It actually shows the importance the person confers onto a phenomenon even if it is not easily verbalized in daily life and, what is more important, it captures changes and differences of how the world is perceived by the person at syn- and diachronic levels.

The concept is a multidimensional meaningful mental construct, including "sign body" (sound cover of the word), notion (unit, reflecting objectively significant features in concepts), conception (subjective sensory images of reality, depending on the individual characteristics: experience, age, academic background, having previously influenced sensory receptors), subject content (reflects the involvement of an object, phenomenon in any type of activities), estimations, emotions, associations (Пищальникова, Рогозина, 2004). Namely the functional and dynamic relationship between the stable components of the concept, and the change in the relations between them indicate the emergence of a qualitatively new content concept.

The third part of the research was the discussion organized during extra foreign language classes, based on the studies of high school teachers, aimed at changing the educational landscape, capable to make it much more appealing and challenging. After the third session, the same tests were again offered to the students. The research was finalized with the Self-Reported Questionnaire (SRQ) incorporating three questions.

Procedure. All the participants were explained that data would be collected through word association responses and Stroop Colour Word test before the first session and after the third one. All the necessary instructions were given to them. SCWT was conducted with each study participant individually. All instructions were presented on a laptop screen, if necessary, they were additionally repeated by an experimenter orally. The study participant was sitting in front of the monitor at a comfortable distance for himself. The experimenter stood alongside of a tested person so as to have opportunity to see the monitor. The participants were instructed that they would be demonstrated words printed in colors that do not correspond to the written word with the goal to name the color in which the word is written, ignoring the meaning of the written word to give their verbal response to the stimulus quickly and accurately without making errors (e.g., if the word "blue" is written in yellow, the examinee must say "yellow"). The software records the time of the stimulus onset.

The FAT included 10 words. 5 of them were aimed to identify the students' views and experiences of the concepts connected with the ideas discussed. The others were used as distractors designed to disguise the true purpose of the FAT. As stimuli we used the words *game*, *science*, *research*, *language*. Tests were distributed among the participants with the task to write next to each stimulus word the first association that came to their mind. Each student placed his/her age, gender, and ethnic and religious affiliation on the test. For the sake of clarity a few examples were provided in oral form before the start of the test. The necessity of spontaneity of the answers was stressed.

The research procedure included 3 sessions in the course of which the researchers asked the participants problematic questions that could not be responded to without in-depth reflection on the perspective, which forced the students to acquaint themselves with diverse viewpoints, justify those, and the

participants understood that their own position on the topic was far from reality, and seeing different facets of the problem, often changed their attitudes.

The first session lasted 2 months and was based on the scientific research about gamification (Тихонова, 2015), which many students treated as experts. This session was designed to familiarize the students with the concept, which states that gaming technologies in non-gaming processes change educational reality and allow to pursue fundamentally different results. Thus, after reviewing the new interpretation of gamification, students had to abandon the original categorical judgments associated with the term (thereby demonstrating a penchant for CF). The second session continued 2 months and was centered around the scientific article about analysis of English radio news as a teaching method (Резепова, 2009). This session was focused on the CF development, reflected in a greater involvement and desire to participate in research activities. The participants already began to offer ways to detect peculiarities adhered to the text's structure in English radio news, analyzed texts from BBC Radio 4, comparing the styling of sounding voice and various Internet communications. For the first time the students generated an idea about a need to fix the features identified by them for the rest to be able to learn these and engage in similar research. The third session went on 1 month and was carried out on the basis of the scientific article about storytelling (Тихонова, 2016), through which students familiarized themselves with a new technique of theoretical material positioning, for example, by means of introducing characters. The session was aimed at testing themselves in educational practice and subsequent change of students' perception in science and science as a notion. Here they, in reality, have assessed, as seemingly small research on creating of an educational history changes the focus of narration and perception of the material, how much better it is understood, and tried different variants of its representation. The students again expressed their desire to fix the material in the article form, noted a necessity for further study of the issue, as it can greatly affect the efficiency of the educational process.

After the third session, the same tests were again offered to the students. Sessions have been held to identify their attitude to being engaged in scientific research and its inclusion into the educational process. Self-Reported Questionnaire incorporated the three following questions:

- How do you feel about your activities within the boundaries of the research?
- While performing the tasks referred to the research areas what captured you most of all?
- Do you believe that it is justified and necessary to combine scientific and educational activities at the University?

Results and discussion

The Stroop Colour Word Effect allowed to test the changes connected with CF and focused attention of the research participants. The participants showed a significant decrease in response time on the stimuli being demonstrated (Table 1). Findings were statistically analyzed via use of *Wilcoxon signed rank test*. Calculated p-value happened to be less than 0.05, that enables to infer on the existence of statistically significant difference in findings obtained from 156 participants in Pre and Post-tests.

Table 1

Changes in average RT^a of the participants while performing The Stroop Colour Word Test

Pre-test	Post-test
43,7	27,5

Note. P-value < 2.2e-16. Evaluation is based on *Wilcoxon signed-rank test*.

^aReaction Time.

To verify the findings the FAT was applied. Being limited by the format of the article, we cannot address the structure of each concept behind the cue words, so the concept "research" was chosen for the analysis as potentially most clearly reflecting students attitude towards science and academic activities. The figure shows the ratio of the concept "research" components, obtained through the FAT.

According to the received data in the Pre-test the following most common associations were obtained: - **notions**: knowledge (5), facts (3), studying (9), information (5), process (3), analysis (2) (66 % of the total number of the associations); - **conceptions**: science (31), innovation (7), laboratory (5), scientist (37), reveal (5), discovery (6), evidence (5), results (1), formula (1), basis (1), figures (4) (18 %); -

estimations and emotions: empty (3), wasting time (5), difficult (11), nonsense (1), rubbish (1), smth new (3) (16 %).

After the Post-test responses were subdivided into the following groups: - **notions:** knowledge (4), facts (2), studying (7), information (5), process (3), analysis (2), activity (20) (29 %); - **conceptions:** interesting (8), empty (1), wasting time (1), difficult (9), nonsense (1), rubbish (1), smth new (5), in need (5), inspiration (3), improving reality (4) (46 %); - **emotions and estimations:** science (5), innovation (9), laboratory (1), scientist (8), reveal (6), discovery (6), evidence (5), results (16), formula (1), basis (1), figures (3), university (11) (25 %).

Analysis of the results reveals the transformation of the concept structure in the minds of the research participants: the first presentation of the words stimuli identified predominantly neutral attitude to the very concept of "research". The prepotency of the conceptual component in the concept structure demonstrates, in our view, distant, quite neutral attitude of the participants to the very concept of "research". The structural component of "conception" includes fairly neutral associations related to the subject field "science". However, "emotions and estimations" component includes mainly negatively colored perception of the concept, marking it as "empty, wasting time, difficult, nonsense, rubbish".

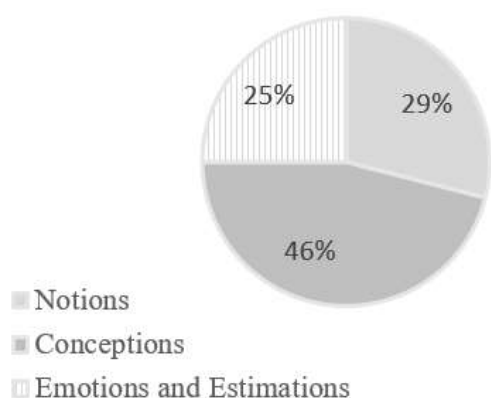


Figure 1. "Research" concept structure (Post-Test).

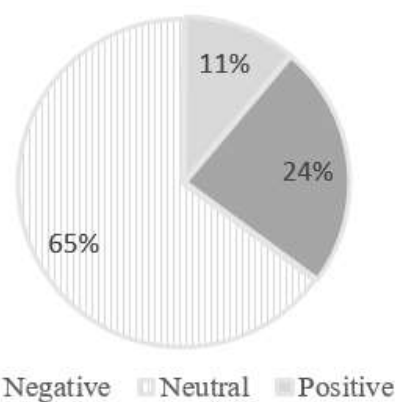


Figure 2. "Research" concept structure: Emotions and Estimations (Post-Test).

Post-test results recorded percentage change in components: "concepts", "emotions and estimations" rose (Figure 1). In so doing, emotional-evaluative tone of perspective perception has changed significantly in a positive way (65 %) from all emotional-evaluative reactions being fixed (Figure 2). That, in our view, proves a positive impact of the research activities undertaken by the participants in its process, on facilitation of their attitude transformation.

Interestingly, in the component "conceptions" there emerged responses "university" (11 responses): if primarily students didn't relate the research to universities, at this stage the research activities happened to be perceived by them as related ones within the educational process. It should be of a special note that comparisons for differences in responses received from the participants with different religious and ethnical backgrounds revealed almost identical performance on all tests. Thus, their data were analysed as a single group of N = 156 students.

Through the SRQ, offered for filling in as a final stage of the measurement, we succeeded in identifying the following trends in evaluation of the activities being performed by them.

While answering the first question in the SRQ (*How do you feel about your activities within the boundaries of the research?*), the majority of the participants (76 %) evaluated their research activities on the course of the study positively, 20 % - neutrally, 3 % - negatively, 1 % - refused to reply. In the process of reasoning their interest towards implemented activities the participants emphasized that the found academic activities can be applicable as they tracked a connection of theoretical research with real life. The very notion of "research" lost the aura of mystery for them by showing its real value, the possibility of incorporating the identified patterns and realities in their routine practice. The participants were surprised with a potential chance to have a direct impact on the educational paradigm: such awareness was shown by 32 % that, in our view, reflects a serious shift in their cognitive evaluations. Interestingly, quite many noted a positive influence of the implemented activities on the development

of English communicative competence: a passion for process suppressed fear of expressing their points of view in a foreign language, stimulated desire to develop academic writing speech (45 %). Through such activities the participants marked the opportunity to not only develop cooperative qualities, ability to work in a team, but an independent position, a well-reasoned grounding, critical thinking: as in the academic context misappropriation of another's point of view is seen as impossible in principle.

Comments on the second question (*While performing the tasks referred to the research areas what captured you most of all?*) formed successive priorities of the research participants (listed the most frequent answers): (1) acquaintance with the phenomena, which were previously unfamiliar (44 %); (2) inability to explain the studied phenomena with relevant life experience and knowledge, hence active cognition of new (self-consistently as well) (29 %); (3) a new vision of the phenomena and processes (7 %). There were some negative comments about a need for considerable time, no real need to participate in such activities because they are not so important for future professional engagement. However, a critical position was demonstrated only by 1,5 % of the participants. Neutral statements to uniquely identify evaluation of the research by the recipients were fixed as well: e.g., interesting but difficult; ability to collaborate with other students, unusual.

The third question (*Do you believe that it is justified and necessary to combine scientific and educational activities at the University?*) revealed that more than 76 % of the participants, to varying degrees, were interested in bringing scientific and research activities in academic sphere, and expressed their willingness to actively participate in those, since it promotes educational horizons, personal growth, develops skills for multitasking, improves understanding of infeasibility of a unified and inflexible viewpoint. Another 15 % marked neutral attitude to the described phenomenon, stating that, although they liked to participate in the study, they find such activities time-consuming and would prefer to momentarily take part in them.

Conclusions

The research has indicated that the hypotheses were only partially confirmed.

Registered findings demonstrate development of the CF in a situation of an active students' involvement in joint research activities with their teachers. Many participants really confirmed a change in attitude towards their own rigidity of judgements, noting the necessity of refraining from explicitness in the approaches to the reality interpretation, having expressed an interest to implement multiple tasks simultaneously.

Clear motivation of the students to participate in the research, producing their autonomous and creative solutions, their willingness to reason the viewpoints in discussions prove the relevance of maximum incorporation of academic activities in educational practice. We are talking about independent, serious research (albeit in a mini format) in a collaboration with university professors, as they seriously improve working atmosphere, and promote maximum cooperation within the chain teacher-student, student-student. Meanwhile, the five and six-year students did not demonstrate a more developed level of the cognitive flexibility comparing to the first and second year students.

Researcher' approbation of their concepts in the classroom and immediate feedback to them, in our view, contributes greatly to their optimum incorporation into the educational practice. The investigated statements of the article, despite the need for further testing and longer research, are of interest in the context of building the most effective educational concepts.

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