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THE ROLE OF FEEDBACK TYPE IN SELF-REGULATION OF LEARNING GOALS ACHIEVEMENT

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Abstract

In the present article, we investigate how students with high and low conscious self-regulation and different preferred strategies of goal achieving use intentionally organized feedback to gain maximum points in experimental tasks. Consistent with previous research our results revealed that feedback played an important role in achieving learning goals. Based on the proposition that feedback can be attributed to one of the two types (discrepancy and velocity), we compared the dynamics of results in the groups with different goal achievement strategies and different levels of self-regulation. We hypothesize that *discrepancy feedback* will significantly increase experimental test results for students with high level of self-regulation and *discrepancy* strategy preference. Students with preference of *velocity* strategy will not improve their test results significantly. We used software application for diagnosis and experimental study of individual self-regulation actions «Diagnosis of situational specificity of self-regulation - DSSSR» (Morosanova, Bondarenko, 2015). DSSSR includes Self-Regulation Profile Questionnaire (SRPLQM, Morosanova, 2011) to diagnose students' self-regulation stylistic features. The obtained results (N=103) allow us to state that we revealed differences in the dynamics of students' results enhancement when they carried out the same experimental tasks in testing with intentionally organized feedback. The results of the students who preferred discrepancy strategy (regardless their self-regulation levels) increased significantly. The students with the strategy of velocity increased their results slightly. This trend is especially noticeable for students with low self-regulation. The role of velocity feedback in self-regulation of learning goals achievement for students with strategy of velocity was discussed.

Keywords: Conscious self-regulation, feedback, velocity, discrepancy, learning goals achievement

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1. Introduction

Researchers have suggested self-regulation (SR) as an essential factor in students' academic achievement (Boekaerts, Pintrich, Zeidner, 2005; Diseth, Kobbeltvedt, 2010; Elliot, McGregor, 2001; Pintrich, De Groot, 1990; Zimmerman, 2001; Morosanova, Fomina, Bondarenko, 2015). We define SR as the continual process of setting goals and moving toward those goal states via feedback (Carver, Scheier, 1998; Johnson, Howe Chang, 2013. Literature on SR shows that there are different views on the nature and structure of self-regulation. Most researchers focus on goal setting — the ability to set learning goals (Schunk, 1994; Zimmerman, Bandura, Martinez-Pons, 1992). Other scientists analyze volitional (Corno, 2001), cognitive (Winne, 1995), and sociocultural (McCaslin and Hickey, 2001) aspects of SR. We define self-regulation of learning activity as a system of self-conscious mental activity used to set educational goals and achieve results, corresponding to those objectives. This process is implemented through a multi-level system, which has a certain structure of interrelated components. The main components are Goal of the activity (as it is understood and accepted by subject); Subjective model of activity conditions significant for the achievement of the goal; Program of activity; System of criteria of goal achievement; Evaluation of information regarding the results of the activity. Individual student's self-regulation can be characterized by a self-regulation profile, including indicators of cognitive functional processes: Goal planning, Modelling of significant conditions, Programming of actions, Results evaluation and instrumental personal-regulatory features: Flexibility, Independence, Reliability, Responsibility (Morosanova, 2013).

2. Problem Statement

Feedback plays the main role in the process of goal achievement SR (Erez, 1977; Neubert, 1998; Locke, Latham, 2002). Previous studies have shown that feedback is one of the key factors in the system of learning activity regulation (Konopkin 2004; Butler, Winne, 1995; Pekrun et al., 2002; Hattie, Timperley, 2007; Morosanova, Bondarenko, 2016). Studies showed that SR involves altering ones behavior or cognition in order to reduce discrepancies between ones current and goal states. Without feedback, there can be neither discrepancy, nor the corrective motivation that results from detecting a discrepancy, because feedback communicates to people the status of their current state (Bandura, Cervone, 1983; Campion, Lord, 1982; Johnson, Howe, Chang, 2013). Investigators indicate different types of feedback during the goal-striving process (Carver, Scheier, 1998; Chang, Johnson, Lord, 2010; Jonson et al., 2006). Discrepancy feedback indicates the distance between actual and goal states and velocity feedback – the rate at which actual-goal discrepancies are decreasing. There are feedback specifics for learning activities: directly correcting incorrect answers ("input-providing") and cue-signs, which push students to correct a wrong answer "output-pushing" (Ellis, 2006); feedback on learning progress, which shows what student did well, what he needs to improve and how to do that (Hattie, Timperley, 2007). It is also significant whether feedback is positive or negative. Studies have confirmed that feedback enhances academic achievement, supports academic motivation (Wigfield, Klauda, and Cambria, 2011) and self-regulation (Zimmerman, Schunk, 2001).

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The paper is aimed at identifying how students with high and low conscious self-regulation and different preferred strategies of goal achieving use intentionally organized feedback to gain maximum points in experimental tasks.

3. Research Questions

Morosanova and Bondarenko measured students' general level of SR and revealed that students with high level of SR usually prefer goal of accuracy (making minimum mistakes). They slowly and carefully studied guidance, possible difficulties and ways of overcoming them. Such behavior indicates a developed conscious SR and ability to operate with visual-figurative or abstract forms in mental goal representation (Morosanova, Bondarenko, 2016). O.A. Konopkin considered this ability to be an important sign of a developed General ability for SR (Konopkin, 2004). Miyake considers this ability as an experimental indicator of regulatory function of planning behavior (Miyake et al., 2000). We found that students could be divided into two groups: some students prefer to achieve goals quickly (velocity strategy), others - not to make mistakes (discrepancy strategy).

The study had the following research tasks:

- to identify students with high and low general levels of self-regulation,
- in these two groups to point out the students who try to achieve goals as fast as possible and those who try not to make mistakes,
- to evaluate the differences in experimental tasks results in the four groups, in situations with minimal feedback and intentionally organized feedback,
- on the basis of the obtained data to accept or reject the hypotheses of the study.

4. Purpose of the Study

We hypothesize that discrepancy feedback will significantly increase experimental test results for students with high level of SR and discrepancy strategy preference. Students with preference of velocity strategy will not improve their test results significantly.

To prove this hypothesis we used software with game-like experimental tasks, "Diagnosis of situational specificity of self-regulation (DSSSR)". This method allows us to compare current manifestation of self-regulation when performing tasks of varying complexity, and to assess the results of the experimental tasks with different type of feedback. We use experimental method because that it is not just that students tell us about their self-regulation, but it gives us understanding how they self-regulate their actions in situations with different feedback. Students received the following feedback: direct and objective progress of task fulfillment, information about understanding and remembering instructions, "input-providing" feedback.

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5. Research Methods

5.1. Participants

The sample group consisted of 103 12-15 year old students of Russian secondary schools (M=13.81). All participants were in the 7th, 8th, 9th grades of the Russian formal educational system. At this age self-concept and criticality level are underdeveloped. Therefore, data of questionnaires we supplemented with data of experimental method to investigate self-regulation in various atypical situations, when students perform new and changing tasks. Studies were conducted in computer classes; students filled in the questionnaires and then performed the experimental tasks.

5.2. Measures

- To evaluate the regulatory features we used «Self-Regulation Profile of Learning Activity Questionnaire – SRPLAQ» created by Dr. Morosanova which measured the level of students' self-regulation of learning activity. SRPLAQ includes 45 statements that describe typical situations concerning the achievement of learning goals. These statements are grouped into the following six scales: Planning (as setting and achieving goals), Modeling (of significant, subjective internal and external conditions for goal achievement), Programming (of actions), Results Evaluation, Flexibility, Independence (Morosanova, Bondarenko, 2015). Each statement is rated on a scale of four (yes, probably yes, probably no, no). High scores (maximum 9) denote high self-regulation. An integrative scale — the General level of conscious self-regulation— is estimated by adding the scores together (up to 58).
- We used software application for diagnosis and experimental study of individual self-regulation features «Diagnosis of situational specificity of self-regulation - DSSSR» (Morosanova, Bondarenko, 2015). This software simulates different learning activity contexts and provides data about students' regulatory and personal characteristics and various information about goals achievement strategies and dynamic of test results. DSSSR consists of two game-like tasks "Memory" and "Navigator". Tasks are not logical or mathematical, i.e. the only true solution does not exist. Data of test results, level of self-regulation processes and regulatory-personal features are collected from the points obtained; time of the tasks fulfillment; number of errors; time of reading guidance notes and etc. Students choose a goal: to complete a task with minimal number of errors or to complete the task as quickly as possible and gain maximum points. "Memory" is a specially adapted game in which one must find paired cards. Results depend on number of actions, number of errors and time spent on reading the guidance.

  Task "Navigator" invites student to control a ship from start to finish overcoming various obstacles. It allows us to estimate the level of mental goal representation. Path pre-selected by student is not fully displayed on the screen. The program simulates the real situation of ship control, when student sees only a part of the path. Obstacles arise as ship moves towards the goal. It moves inside two invisible corridors. If it crosses the border of internal corridor, the

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program gives a warning to return to the path. When the ship passes the external border corridor, the player is forcibly returned to the start.

When student presses spacebar, two arrows appear near the ship. One arrow indicates the direction to finish, the other one - direction to the path. Students with high level of mental goal representation usually figure out that the fastest way to finish the task as well as to get maximum points is to move the ship moves along the bisector of the angle formed by the arrows.

At the process of task execution, students receive the following feedback: direct and objective progress of task fulfillment, information about understanding and remembering instructions, "input-providing" feedback.

6. Findings

To explore the role of feedback in self-regulation of experimental tasks fulfilment we selected two groups of students with high (M=33.6 n=36) and low levels of SR (M=16.4, n=24). In each group, we separated students with strategy of *discrepancy* and *velocity* and compared their results. Final sample of students with strategy of discrepancy consisted of 19 students with high SR and 14 – with low SR. The sample of students with strategy of velocity consisted of 17 students with high SR and 10 – with low SR. Tables 1 and 2 show the results of experimental tasks performance.

Our previous results revealed that participants with high, medium and low general level of self-regulation chose different performance strategies in situations with minimum feedback and intentionally organized feedback (Bondarenko, 2016). Intentionally organized feedback means that before carrying out the experimental tasks, students have to answer questions, which help them understand and remember instructions. We compared the results of Memory and Navigator tasks in experimental situations (Result 1 and Result 2, correspondingly). Additionally, the tables contain some measures that are important for achieving high results: reading the guidance, error-free use of keystrokes, and using spacebar for controlling the ship. Comparative analysis of averages by Mann-Whitney method showed significant distinctions for most of these indicators.

Table 01. Comparison of DSSSR results with minimum feedback (Results 1) and intentionally organized feedback (Results 2) for subjects with high General level of self-regulation (M=33.6) divided on two groups ((1) completed the task with minimal numbers of errors (discrepancy) and (2) completed the task as quickly as possible (velocity))

	Result 1							**Result 1**						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Discrepancy	2.6	2.36	1725	11.8	38	1810	3842	1.27	1.6	1862	7.06	39	1999	3954
Velocity	35.8	.50	1644	27.2	77	1767	3421	4	2.35	1687	5.5	104	1814	3514

1 - number of errors in task Memory, 2 - time spent on reading the guidance to Memory (sec), 3 - total number of points per game Memory, 4 - the first time of press spacebar (visual observation) (sec), 5 - the number of observations, 6 - total number of points per game Navigator, 7 - total number of points over the two tests (Memory and Navigator)

Our results provide evidence that students with high SR and discrepancy strategy significantly improve their results in the tasks with intentionally organized feedback. The results of students with the

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strategy of velocity are also improved, but only slightly. The reason may be little time spent on reading the guidance that leads to a large number of errors. These students realize that the program provides a reliable way to control the ship much later than the students with strategy of discrepancy (27.2 seconds compared to 11 seconds). They intensively use spacebar in the task with intentionally organized feedback (104 vs. 39).

We revealed that results of students with low level of SR show the similar patterns (Table 2). Our findings also highlight the results of students with low level of SR and strategy of velocity. They are the least successful group in all tasks. They do not read guidance and start with making a large number of errors. Even after finding a reliable way of achieving the goal rapidly, they do not use it spacebar when performing the second task, as if they have forgotten about it.

Table 02. Comparison of DSSSR results with minimum feedback (Results 1) and intentionally organized feedback (Results 2) for subjects with low General level of self-regulation (M=16.4) divided on two groups ((1) completed the task with minimal numbers of errors (discrepancy) and (2) completed the task as quickly as possible (velocity))

	Result 1							**Result 1**						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
Discrepancy	2.53	1.88	1797	11.5	23	1744	3804	1.14	1.65	1851	8.4	26	1957	3850
Velocity	28.6	.30	1611	44.3	101	1716	3357	1	2.5	1727	5.2	47	1778	3328

1 - number of errors in task Memory, 2 - time spent on reading the guidance to Memory (sec), 3 - total number of points per game Memory, 4 - the first time of press spacebar (visual observation) (sec), 5 - the number of observations, 6 - total number of points per game Navigator, 7 - total number of points over the two tests (Memory and Navigator)

The findings of this study indicate that students with strategy of velocity are unable to take advantage of feedback provided by DSSSR program. Intentionally organized feedback has not improved their results significantly.

This study was motivated by lack of research on how velocity feedback increases students' experimental tasks performance. Jonson highlighted that the majority of research on goal achievement emphasized discrepancy feedback while overlooking velocity feedback (Johnson, Chang, Howe, 2012). Feedback in learning activity has its own specifics. Butler and Winne define feedback in learning activity as information that allows the student to confirm, amplify, modify, regulate, and restructure already existing data. The researchers underline that feedback can be relevant both to the subject area and to ideas of students about themselves or tasks, and cognitive strategies (Butler & Winne 1995). We argue that researchers describe, first and utmost, discrepancy feedback. In this case, we cannot use the benefits of velocity feedback, which generates during self-regulation the following outcomes: positive and negative affect (Carver, Scheier, 1998), facilitates communication across different levels in goal hierarchies (Johnson et al. 2006).

In the current paper, we investigated how students with high and low conscious self-regulation and different preferred strategies of goal achieving use discrepancy and velocity feedback. We expected that these differences are most likely to be revealed in high demand situations ("when the going gets tough").

Morosanova and Bondarenko showed that students with higher general levels of SR with harmoniously high levels of SR processes choose a goal of "no errors" (discrepancy) more often,

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carefully read guidance, and make less incorrect actions. They have inner plan of interaction with reality, which helps them to search the ways to perform the task correctly and quickly (Bondarenko, 2017).

The present study results showed that students with high and low self-regulation differ in experimental tasks performance. The arguments listed above may provide an explanation for this fact. Nevertheless, we also revealed differences in the dynamics of students' results enhancement when they carried out the same experimental tasks in testing with intentionally organized feedback. Results of the students with a preference for discrepancy strategy (regardless of the level of SR) increase significantly. The students with the strategy of velocity increase the results slightly. This trend is especially noticeable for students with low SR.

We can conclude that if velocity feedback is underestimated and sometimes depreciated in learning activity ("Haste makes waste"), then some categories of students do not get the necessary information about goal striving. Whereas, recent studies in organizational psychology have shown that it is possible to identify three major trends in the current research concerning velocity feedback, including the effects of velocity on affective responses during goal pursuit, the effects of velocity on persistence and goal revision, and velocity in multiple goal contexts (Johnson, Chang, Howe, 2013). The number of similar studies in learning activity is extremely small. The results of our research show that students who choose the strategy of velocity are predominantly characterized with average and low academic success and low levels of self-regulation. Velocity feedback could help them use the tactics and behaviors that fit them to improve their task execution results and academic success.

7. Conclusion

This study examined the role of feedback in experimental tasks performance by the students with high and low level of self-regulation. Results revealed that despite the importance of velocity in self-regulation of goal achievement much of the empirical works has focused on discrepancy, that is to say, on reducing the number of errors in learning activity. Consistent with previous research our results revealed that feedback played an important role in achieving learning goals. In situation with intentionally organized feedback, all the participants improved their results. However results of this study show that discrepancy feedback significantly increases experimental test results for students with high level of SR and discrepancy strategy preference. Students with preference of *velocity* strategy will not improve their test results significantly. Further studies should explore 1) what kind of velocity feedback will contribute to students' academic success; 2) what is the mechanics of this process.

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