THE EFFECT OF CHOOSING VERSUS RECEIVING FEEDBACK ON COLLEGE STUDENTS' PERFORMANCE

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ABSTRACT

This study examines the effect of choosing versus receiving feedback on the learning performance of n = 98 post-secondary students from California on a digital poster design task. The study employs a yoked experimental design where college students are randomly assigned to play a choice-based assessment game, Posterlet, in one of two conditions, Choose or Receive. In the Choose condition, students choose confirmatory (i.e., positive) or critical (i.e., negative) feedback about their posters. In the Receive condition, students are assigned the same feedback valence that students in the Choose condition chose. Results show that 1) critical feedback and revision are positively associated with learning performance when students choose their feedback, but critical feedback is negatively associated with learning performance when students receive their feedback; 2) there is no significant effect of feedback choice between conditions; and 3) students enjoy and spend time designing posters significantly more when they choose rather than receive their feedback. Implications for designing feedback-rich environments are discussed.

KEYWORDS

Feedback, Choice, Assessment, Game, Learning, Performance

1. INTRODUCTION

Feedback plays a major role in educational performance, but it yields mixed results within the educational literature (Hattie and Timperley, 2007). Several meta-analyses found that, although feedback improved performance in general, it had no effect or it hindered performance in a third of the studies examined (Alfieri et al., 2011; Bangert-Drowns et al., 1991; Kluger and DeNisi, 1998). Moreover, the role of feedback valence (i.e., confirmatory or critical) on performance is still a matter of debate (Fishbach et al., 2010; Gregory and Levy, 2015). Furthermore, most research focuses on feedback being assigned to the learner. In contrast, in previous research, the impact of feedback choice on performance in an educational setting was investigated and results indicated that choosing critical feedback was positively associated with learning and performance (Cutumisu et al., 2015). Additionally, in the current study, the effect of feedback agency (i.e., choosing versus receiving feedback) on college students' performance is examined for the first time. This topic has wide applicability. For example, in medical research, patients who had control over their level of pain medication chose lower doses than those prescribed by medical staff (Haydon et al., 2011). In educational research, an open research question of relevance for designing feedback environments is whether students who have control over their feedback valence choose more critical feedback and learn more than students who receive (i.e., are assigned) feedback. Therefore, this paper starts tackling this question by focusing on two orthogonal dimensions of feedback: choice (feedback is chosen or assigned) and valence (feedback is confirmatory or critical).

Specifically, this research aims to examine the effect of feedback agency (i.e., choosing versus receiving feedback) on the performance of college students, by comparing learning outcomes between participants who choose feedback and those who are assigned the same amount, valence, and order of feedback. In addition to performance and time on task, students' reported enjoyment of designing posters is assessed. An experimental study was designed to address the following research questions:

1) Does critical feedback correlate with performance outcomes by condition?
2) Are there outcome differences between choosing and receiving feedback?
3) Are there enjoyment differences between choosing and receiving feedback?

The remainder of the paper reviews the related literature, then it describes the experimental study and the methods, it presents evidence of the impact of choosing *versus* receiving feedback on learning outcomes, and it concludes with a discussion and implications of this research.

2. LITERATURE REVIEW

There are many factors that influence the effectiveness of feedback for performance. For example, recent research findings point to factors that include feedback message construction, delivery of critical feedback, credibility of the source, specificity and relevance, and feedback orientation (i.e., an individual's positive affect, interest, and engagement with feedback; Anseel et al., 2015; Ashford et al., 2016; De Stobbeleir et al., 2011; Gregory and Levy, 2015; Landis-Lewis et al., 2015; Porath et al., 2015).

Critical feedback. Moreover, critical feedback seems to aid performance in some situations (Kluger and DeNisi, 1998), with individual factors, such as mindset, affecting engagement with critical feedback (Mangels et al., 2006). Although choosing critical feedback is positively associated with learning (Cutumisu et al., 2015), it is still not known whether it is the choice over feedback or the actual amount of critical feedback that impacts the performance of college students. This suggests that both feedback agency and valence are worth exploring for this population in relation with learning and performance.

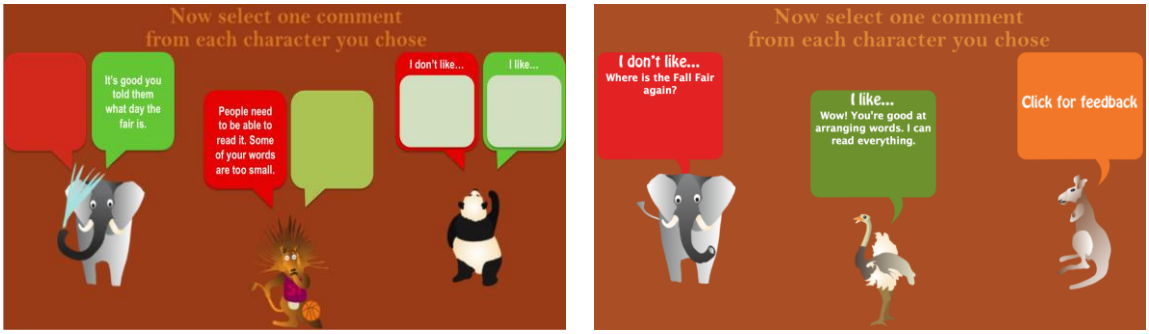
Choice-based assessments. A game-based dynamic assessment, Posterlet, was employed to examine the impact of students' choices to seek critical feedback on performance and learning. In addition to confirmatory and critical feedback choices, Posterlet offers players opportunities to learn graphic design principles while designing a digital poster (Cutumisu et al., 2015). The design of Posterlet draws on constructivist, choice-based assessments (Schwartz et al., 2009; Schwartz and Arena, 2013) that emphasize learning during the assessment and that shift the assessment focus from the learning outcomes to the learning processes (e.g., choosing critical feedback) involved in solving a challenge (e.g., designing a poster). Specifically, in Posterlet, players take on the role of designing posters for booths at a fair. They choose a booth of interest (e.g., basketball toss) and they design a poster using a graphical user interface provided by the game. Posterlet measures two choices that a player makes upon completing a poster: 1) choose either confirmatory or critical feedback from three virtual characters about the poster and 2) choose to revise the poster after reading all three pieces of feedback. A variation of the Posterlet game was specifically designed to enable a performance outcome comparison between college students who choose and those who receive (i.e., are assigned) feedback. In this new version, feedback is assigned to the player in a principled way that mirrors the feedback chosen by a corresponding player of the original Posterlet version.

3. METHODS

3.1 Participants and Procedure

Participants are n = 98 (55 female) students aged 18 to 52, M_{age} = 22.71 years (SD = 5.59) from a college in California. Both versions of the Posterlet game and a post-test were employed to collect data between Spring 2014 and Spring 2015. All participants provided consent and were randomly assigned to one of two conditions, Choose (n = 49 students aged 18 to 52, M_{age} = 22.53 years, SD_{age} = 5.96, 32 female) and Receive (n = 49 students aged 18 to 38, M_{age} = 22.90 years, SD_{age} = 5.26, 23 female), according to a yoked study design described in a related study (Cutumisu and Schwartz, 2016). These conditions correspond to two different game versions. In the Choose game version, students choose their feedback valence, as illustrated in **Figure 1**a, by selecting either critical or confirmatory feedback from each virtual character. In the Receive game version, students are assigned their feedback valence, as illustrated in **Figure 1**b. After designing posters in two rounds of the game for M_{Choose} = 8.72 minutes (SD = 3.28) and $M_{Receive}$ = 7.54 minutes

(SD = 3.84), all participants completed the same online post-test that measured their knowledge of graphic design principles and enjoyment of designing posters. The time students spent on the post-test in each condition was M_{Choose} = 6.56 minutes (SD = 1.44) and $M_{Receive}$ = 7.58 minutes (SD = 5.49), respectively.



a **b**

Figure 1. In the Choose condition (a), the player chose critical feedback from the lion and then confirmatory feedback from the elephant. In the Receive condition (b), the player first received critical feedback from the elephant and then confirmatory feedback from the ostrich

3.2 Measures and Data Sources

Students completed one of two versions of the game, with the primary difference being whether 1) they chose between critical and confirmatory feedback or 2) they were assigned a schedule of critical and confirmatory feedback (Cutumisu and Schwartz, 2016). Posterlet measured students' behaviors and performance in the game. A post-test following the game measured students' knowledge of graphic design principles acquired through playing Posterlet.

Measures of student choices. *Critical Feedback* measures the number of times that the student chose or received critical (i.e., *I don't like*) feedback, ranging from 0 (students chose/received only confirmatory feedback across the game) to 6 (students chose/received only critical feedback across the game). *Revision* measures the number of times that the student chose to revise a poster, ranging from 0 (the student did not revise any posters) to 2 (the student revised both posters). All students had a choice to revise their posters, even though students in the Receive condition did not have a choice regarding the valence of their feedback.

Measures of student performance. *Poster Quality* measures the poster performance (i.e., the quality of the posters created by the student in Posterlet). The game evaluates each poster against a set of 21 graphic design rules provided by a graphic artist. For each poster, the game evaluates each rule with 1, if the rule is always used correctly on that poster; 0, if the rule is not applicable on that poster; and -1, if the rule is used incorrectly on that poster. The score of any individual poster created by a student represents the sum of all 21 rule scores, ranging from -21 to 21. Thus, Poster Quality represents the score sum across the game of the last individual poster on each round, ranging from -42 to 42.

Measures of time on task. *Design Duration* measures the amount of time (in minutes) students spent designing all posters, including revisions. Specifically, the game starts measuring the time a student spends from choosing a poster theme (e.g., basketball) until submitting the first poster draft. If the student chooses to revise the poster after reading the feedback, then this measure includes the additional time that the student spends updating that poster.

Measures of student learning. *Poster Ranking* measures a student's knowledge of design principles on a post-test independent of the game. After completing the game, the student is directed to an online post-test to assess four sets of posters. Each set contains two versions of a poster, featuring a design principle used correctly on one poster and incorrectly on the other poster. For each set, the student is shown in a five-second succession the first poster, a pattern image, and a modified version of the first poster, as illustrated in **Figure 2**. Then, the student decides whether the second poster is the same, better, or worse than the first poster. Each answer is scored with 1, if it is correct and 0, if it is incorrect. Thus, Poster Ranking ranges from 0 to 4.

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Measures of Enjoyment. *Enjoyment* measures the enjoyment of designing posters on a 1-5 Likert-type response scale, where 1 = *none* and 5 = *a huge amount*. Students answered this question after completing the game and the post-test.

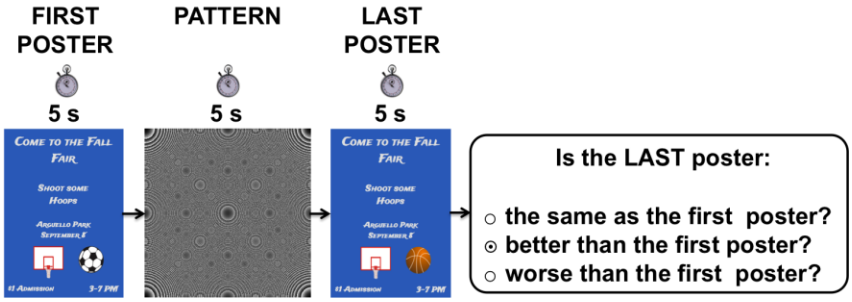


Figure 2. One of the four post-test items measuring students' knowledge of graphic design principles. This item's target feature is the relevance of graphics (a basket ball instead of a soccer ball) for the poster's theme (basketball)

4. RESULTS

4.1 Does Critical Feedback Correlate with Performance Outcomes by Condition?

Spearman's rank correlation coefficient (*rho*) is reported in all the analyses included in this section, because the variables measured were not normally distributed. In the Choose condition, Critical Feedback correlates with performance on the posters measured by Poster Quality and strongly with Revision, as shown in Table 1. The in-game poster performance (Poster Quality) can be considered to be a learning measure, because students improved their performance from the first to the second game round. Poster 1 is considered to be the pretest, being the first poster designed by the player in the Posterlet game, before revision. Poster 2 is the last poster designed by the student in the Posterlet game, after a potential revision. A repeated measures ANOVA analysis reveals that the poster quality of the students in the Choose condition increased significantly from Poster 1 (M = 9.59, SD = 5.69) to Poster 2 (M = 13.04, SD = 3.96); $F(1, 48) = 24.67$, $p < .001$, partial eta squared = .34. As well, in the Receive condition, poster quality increased significantly from Poster 1 (M = 9.33, SD = 6.93) to Poster 2 (M = 12.63, SD = 4.37); $F(1, 48) = 14.72$, $p < .001$, partial eta squared = .23. Critical Feedback also correlates positively with Poster Ranking, although not statistically significantly.

Table 1. Correlations between choices and performance outcomes (in-game and post-test) in the Choose condition

Measures (n = 49)	Revision	Poster Quality	Poster Ranking
Critical Feedback	**.64****	**.28***	.22
Revision	--	.27	.14
Poster Quality	--	--	.18
	** $p < .01$	* $p < .05$	

In the Receive condition, Critical Feedback correlates strongly with Revision and inversely with poster quality, as shown in Table 2. Although not statistically significantly, Critical Feedback also inversely correlates with performance on the graphic design principles measured by Poster Ranking in this condition.

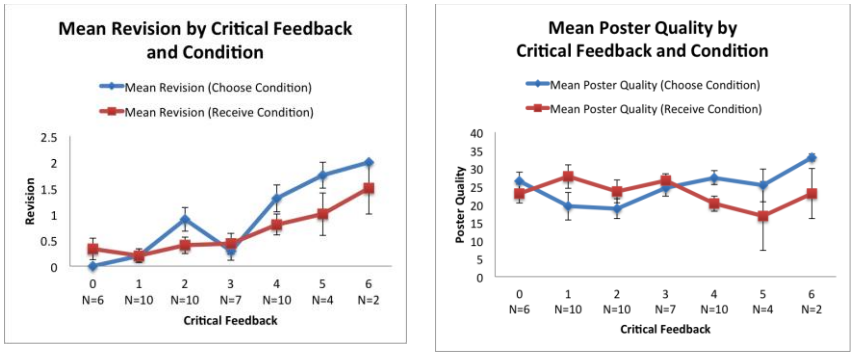
Table 2. Correlations between behaviors and performance outcomes (in-game and post-test) in the Receive condition

Measures (n = 49)	Revision	Poster Quality	Poster Ranking
Critical Feedback	**.44****	-.16	**-.34***
Revision	--	.09	.10
Poster Quality	--	--	.23
	** $p < .01$	* $p < .05$	

Taken together, these results imply that critical feedback correlates positively with learning outcomes only when students exercise a feedback choice, not when they are assigned their feedback. In support of this conclusion, results show that the relation between critical feedback and the measures of learning differs statistically significantly between the two conditions. Specifically, a t-test analysis comparing the correlation coefficients of Critical Feedback and Poster Quality between the Choose and Receive conditions indicated that the two correlation coefficients were statistically significantly different from each other (*z-score* = 2.15, p = .03; Fisher, 1921; Soper, 2016). A comparison of the Critical Feedback and Poster Ranking correlation coefficients between conditions yielded similar results (*z-score* = 2.77, $p < .01$).

4.2 Are there Outcome Differences between Choosing and Receiving Feedback?

Revision. An independent-samples t-test was conducted to compare Revision between students in the two conditions. There were no significant differences in Revision between students in the Choose (M = .76, SD = .83) and Receive condition (M = .53, SD = .62); $t(88.56) = 1.52$, p = .13. **Figure 3**a shows the mean Revision plotted by number of Critical Feedbacks (0-6) for each of the two conditions.



a **b**

Figure 3. Mean Revision (a) and mean Poster Quality (b) by critical feedback and condition

Poster Quality. An independent-samples t-test was conducted to compare Poster Quality between conditions. There were no significant differences in Poster Quality between students in the Choose (M = 23.57, SD = 8.85) and Receive condition (M = 23.51, SD = 9.48); $t(96) = .03$, p = .97. **Figure 3**b shows the mean Poster Quality plotted by Critical Feedback for each of the two conditions. Another independent-samples t-test was conducted to compare the quality of the Pretest (the first poster before revisions) between students in both conditions. There were no significant differences in Pretest between students in the Choose (M = 9.59, SD = 5.69) and Receive condition (M = 9.33, SD = 6.93); $t(96) = .21$, p = .84.

Poster Ranking. An independent-samples t-test was conducted to compare Poster Ranking between students in the two conditions. There were no significant differences in Poster Ranking between students in the Choose (M = 1.71, SD = 1.02) and Receive condition (M = 1.63, SD = 1.07); $t(96) = .39$, p = .70. **Figure 4**a shows the mean Poster Ranking plotted by Critical Feedback for each of the two conditions.

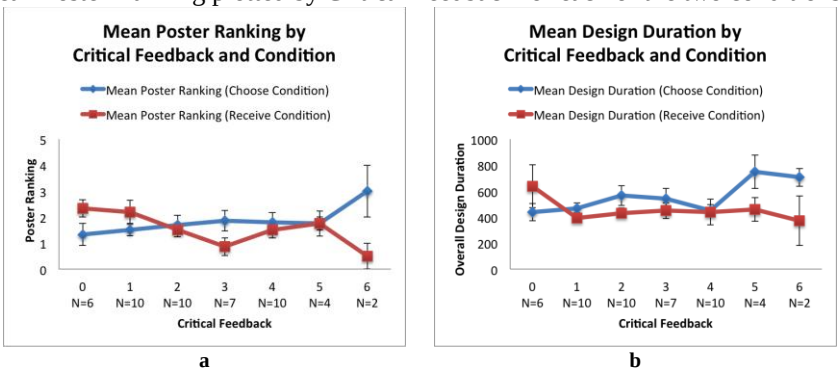


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Figure 4. Mean Poster Ranking (a) and mean Design Duration (b) by critical feedback and condition

Design Duration. An independent-samples t-test was conducted to compare Design Duration between conditions. There were no significant differences in Design Duration between students in the Choose (M = 8.72 minutes, SD = 3.28) and students in the Receive condition (M = 7.54 minutes, SD = 3.84); $t(96) = 1.63$, $p = .11$. **Figure 4**b shows the mean Design Duration plotted by Critical Feedback.

4.3 Are there Enjoyment Differences between Choosing and Receiving Feedback?

An independent-samples t-test was conducted to compare Enjoyment between conditions. Results show that students in the Choose condition (M = 4.03, SD = .80) enjoyed designing posters significantly more than students in the Receive condition (M = 3.45, SD = .91); $t(81) = 2.99$, $p < .01$. **Figure 5** shows the mean Enjoyment plotted by critical feedback for each condition, indicating that enjoyment is hardly affected by the amount of critical feedback, except at the high end. These results suggest that the effect on enjoyment could be simply the existence of choice, rather than the actual valence of the choice. In the Choose condition, 76% of the students reported 4 and 5 levels of enjoyment, as opposed to only 51% of the students in the Receive condition. Moreover, Enjoyment is positively associated with Design Duration (*rho* = .37, $p = .03$) only in the Choose condition.

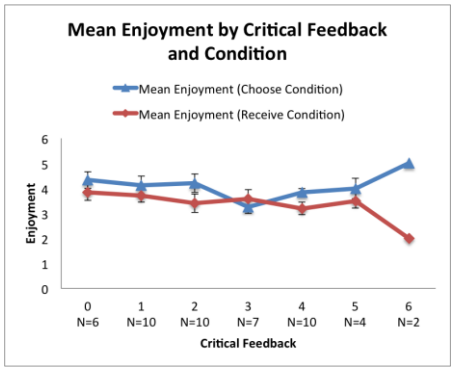

Figure 5. Mean Enjoyment by critical feedback and condition

5. DISCUSSION AND IMPLICATIONS

Critical feedback and performance outcomes. Critical Feedback and Revision were strongly correlated and students improved their poster design performance as they played the game. The more the students chose critical feedback and revised, the better they performed on the poster design task. This is consistent with research reporting that giving children a choice led to better information-seeking performance in a text search task (Reynolds and Symons, 2001). Concomitantly, the more the students were assigned critical feedback, the worse they performed on the post-test. However, the graphical representation of poster ranking by critical feedback per condition suggests that critical feedback could aid performance depending on the amount of critical feedback assigned. A limitation of this study is the reduced amount of data points for each critical feedback value. More data will be collected to better understand how students' performance relates to critical feedback. Overall, critical feedback is associated with better performance when students choose their feedback valence, but with worse performance when they are assigned their feedback valence. One possible explanation for this outcome is that choice can be a source of motivation, which may lead students to engage more with their learning. For example, high-school students who chose which of their homework assignments to complete outperformed their peers who had no choice available (Patall et al., 2010).

Outcome differences between choosing and receiving feedback. This research hypothesized that students who chose feedback performed better than students who were assigned feedback. However, results revealed no effect of feedback choice, consistent with a related prior study examining Mechanical Turk adults (Cutumisu and Schwartz, 2016). There were no differences between conditions in the choice to revise, performance on the posters and on the post-test, and time spent designing posters. This indicates that no underlying variable (e.g., mindset) drives the effect of critical feedback, since assigning the same amount of feedback leads to the same results as other factors that may cause students to choose critical feedback. A limitation of this study could serve as an explanation for this outcome: both game versions consisted of two rounds and five minutes for poster design. Future research will include one more round in each condition and provide more time per round to assess students' performance in both conditions and perhaps note differences.

Enjoyment differences between choosing and receiving feedback. Students in the Choose condition enjoyed designing posters significantly more than those in the Receive condition. Choices can promote a sense of autonomy that could be highly motivating for the students (Deci and Ryan, 1985). Although greater perceived autonomy is associated with higher levels of enjoyment and intrinsic motivation (Reeve et al., 1999), choice is not always a motivator (Katz and Assor, 2007). The finding that enjoyment correlates with the time the students took to design the posters only in the Choose condition supports this motivational hypothesis and is consistent with prior research involving a sample of Mechanical Turk adults (Cutumisu and Schwartz, 2016). The majority of the students reported high levels of enjoyment, which is encouraging for a game that is ultimately an assessment. Thus, games such as Posterlet could be enjoyable assessment environments for college students, especially when they provide feedback valence choices.

Educational implications. One lesson that can be taken away from this study is that choice of feedback seems to play an important role for performance, revision, time on task, and enjoyment for college students. Thus, feedback choice in general, and feedback choice between confirmatory and critical feedback in particular, should be considered as an important feature in instructional environments for this population to maximize feedback's effectiveness in impacting performance and learning. A feedback choice-rich learning and assessment environment could also lead to student enjoyment and more time spent on task. For example, in a physical activity intervention drawing on self-determination theory (Deci and Ryan, 1985), students who were taught by autonomy-supportive teachers participated more frequently in leisure-time physical activities than students who were taught by less autonomy-supportive teachers (Chatzisarantis and Hagger, 2009). Even though no significant differences in outcomes were found between choosing and receiving feedback, engaging with a certain threshold of critical feedback may make a difference for learning. Thus, existing assessment environments that do not provide choices could integrate dynamic ways of adjusting the amount of critical feedback available to students and evaluate their performance in each case.

6. CONCLUSION

The study presented a preliminary comparison between the impact of choosing and receiving feedback on college students' performance. Critical feedback and performance are associated positively when students choose their feedback, but negatively when they are assigned their feedback. The choice to revise is positively associated with performance, but only when students choose their feedback. Students who choose their feedback enjoy designing posters significantly more than students who receive their feedback. Moreover, students who have a choice regarding their feedback also spend significantly more time designing posters than students who are assigned their feedback. Future research in this area needs to address the theoretical underpinnings of feedback valence and choice, and further examine the impact of motivation, enjoyment, and critical feedback on students' performance and learning.

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REFERENCES

Alfieri, L. et al., 2011. Does discovery-based instruction enhance learning? *Journal of Educational Psychology*, Vol. 103, 1–18.

Anseel, F. et al., 2015. How are we doing after 30 years? A meta-analytic review of the antecedents and outcomes of feedback-seeking behavior. *Journal of Management*, Vol. 41, No. 1, 318-348.

Ashford, S. J. et al., 2016. To seek or not to seek: Is that the only question? Recent developments in feedback-seeking literature. *Annual Review of Organizational Psychology and Organizational Behavior*, Vol. 3, 213-239.

Bangert-Drowns, R. L. et al., 1991. The instructional effect of feedback in test-like events. *Review of Educational Research*, Vol. 61, 213–238.

Chatzisarantis, N. L. and Hagger, M. S., 2009. Effects of an intervention based on self-determination theory on self-reported leisure-time physical activity participation. *Psychology and Health*, Vol. 24, No. 1, 29-48.

Cutumisu, M. et al., 2015. Posterlet: A game-based assessment of children's choices to seek feedback and to revise. *Journal of Learning Analytics*, Vol. 2, No. 1, 49-71.

Cutumisu, M. and Schwartz, D., 2016. Choosing versus receiving feedback: The impact of feedback valence on learning in an assessment game. In *Proceedings of the 9th International Conference on Educational Data Mining* (EDM), 341-346, June 29 - July 2, Raleigh, NC, USA.

De Stobbeleir, K. E. et al., 2011. Self-regulation of creativity at work: The role of feedback-seeking behavior in creative performance. *Academy of Management Journal*, Vol. 54, No. 4, 811-831.

Deci, E. L. and Ryan, R. M., 1985. *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum.

Fishbach, A. et al., 2010. How positive and negative feedback motivate goal pursuit. *Social and Personality Psychology Compass*, Vol. 4, No. 8, 517-530.

Fisher, R. A., 1921. On the probable error of a coefficient of correlation deduced from a small sample. *Metron*, 1, 3-32.

Gregory, J. B. and Levy, P. E., 2015. *Using feedback in organizational consulting*. Washington, DC: American Psychological Association.

Hattie, J. and Timperley, H., 2007. The power of feedback. *Review of Educational Research*, Vol. 77, No. 1, pp. 81–112.

Haydon, M. L. et al., 2011. Obstetric outcomes and maternal satisfaction in nulliparous women using patient-controlled epidural analgesia. *American Journal of Obstetrics and Gynecology*, *205*(3), 271-e1.

Katz, I. and Assor, A., 2007. When choice motivates and when it does not. *Educational Psychology Review*, Vol. 19, No. 4, 429-442.

Kluger, A. N. and DeNisi, A., 1998. Feedback interventions: toward the understanding of a double-edged sword. *Current Directions in Psychological Science*, Vol. 7, No. 3, pp. 67–72.

Landis-Lewis, Z. et al., 2015. Computer-supported feedback message tailoring: Theory-informed adaptation of clinical audit and feedback for learning and behaviour change. *Implementation Science*, Vol. 10, No. 12.

Mangels, J. et al., 2006. Why do beliefs about intelligence influence learning success? A social cognitive neuroscience model. *Social Cognitive and Affective neuroscience*, Vol. 1, No. 2.

Patall, E. A. et al., 2010. The effectiveness and relative importance of choice in the classroom. *Journal of Educational Psychology*, Vol. 102, No. 4, p. 896.

Porath, C. L. and Bateman, T. S., 2006. Self-regulation: from goal orientation to job performance. *Journal of Applied Psychology*, Vol. 91, No. 1, 185.

Reeve, J. et al., 1999. Autonomy-supportive teachers: How they teach and motivate students. *Journal of Educational Psychology*, Vol. 91, 537-548

Reynolds, P. L. and Symons, S., 2001. Motivational variables and children's text search. *Journal of Educational Psychology*, Vol. 93, 14–22.

Schwartz, D. L. and Arena, D., 2013. *Measuring what matters most: Choice-based assessments for the digital age*. MIT Press, Cambridge, MA, USA.

Schwartz, D.L. et al., 2009. Constructivism in an age of non-constructivist assessments. *Constructivist Instruction*, 34-61.

Soper, D. S., 2016. Significance of the Difference between Two Correlations Calculator [Software]. Retrieved from: http://www.danielsoper.com/statcalc.