

Testing prospect theory in students' performance

La teoría de las perspectivas en el rendimiento de los estudiantes

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Resumen

This paper tests the existence of 'reference dependence' and 'loss aversion' in students' academic performance. Accordingly, achieving a worse than expected academic performance would have a much stronger effect on students' (dis)satisfaction than obtaining a better than expected grade. Although loss aversion is a well-established finding, some authors have demonstrated that it can be moderated – diminished, to be precise –. Within this line of research, we also examine whether the students' emotional response (satisfaction/dissatisfaction) to their performance can be moderated by different musical stimuli. We design an experiment through which we test loss aversion in students' performance with three conditions: 'classical music', 'heavy music' and 'no music'. The empirical application supports the reference-dependence and loss aversion hypotheses (significant at $p < 0.05$), and the musical stimuli do have an influence on the students' state of satisfaction with the grades (at $p < 0.05$). Analyzing students' perceptions is vital to find the way they process information. Particularly, knowing the elements that can favour not only the academic performance of students but also their attitude towards certain results is fundamental. This study demonstrates that musical stimuli can modify the perceptions of a certain academic result: the effects of 'positive' and 'negative' surprises are higher or lower, not only in function of the size of these surprises, but also according to the musical stimulus received.

Palabras clave: prospect theory, reference dependence, loss aversion, academic performance, musical stimuli.

Abstract

Este trabajo contrasta la existencia de 'puntos de referencia' y la 'aversión a la pérdida' en el rendimiento académico de los estudiantes. De acuerdo con la teoría de las perspectivas, la obtención de un resultado peor al esperado tiene un efecto mayor en la (in)satisfacción de los estudiantes que la obtención de un resultado mejor del que se esperaba. Aunque la aversión a la pérdida es un resultado empírico ampliamente probado en otros contextos, algunos autores han demostrado que puede verse reducido por otros factores. Así, dentro de esta línea de investigación, este trabajo examina si la respuesta emocional de los estudiantes (satisfacción/insatisfacción) a su rendimiento puede verse afectada por distintos estímulos musicales. Se diseña un experimento con el que se contrasta la aversión a la pérdida en el rendimiento de los estudiantes en tres condiciones experimentales: con 'música clásica', 'música *heavy*' y 'sin música'. La aplicación empírica apoya tanto la hipótesis de que existen puntos de referencia como la hipótesis de aversión a la pérdida (ambas significativas al 0,05), y se observa que los estímulos musicales tienen una influencia en el estado de satisfacción de los estudiantes con su rendimiento ($p < 0,05$). El análisis de las percepciones de los estudiantes es vital para conocer la forma en que procesan la información. En particular, es fundamental comprender los elementos que pueden favorecer no solo el rendimiento académico de los estudiantes sino también su actitud hacia ciertos resultados. Este estudio demuestra que los estímulos musicales pueden modificar las percepciones de un determinado resultado académico: los efectos de sorpresas 'positivas' y 'negativas' son mayores o menores, no solo en función del tamaño de estas, sino también del estímulo musical recibido.

Key words: teoría de las perspectivas, puntos de referencia, aversión a la pérdida, rendimiento académico, estímulos musicales.

Introduction

The analysis of the factors and variables that determine students' academic performance is preponderant in the literature (Larson, Britt, and Kurby, 2009). However, knowing the way in which students emotionally perceive their academic results has received less attention (Kitsantas, Reiser Rober and Doster, 2004), although its examination is fundamental as it allows us to identify how they react. In an attempt to look deeper into the generation process of these reactions, this study tests the prospect theory in the context of the emotional responses of students to their academic results. Concretely, it tests the two main pillars of the theory: reference-dependence and loss aversion. The concept of reference-dependence suggests that

people's reactions depend on a mentally fixed reference point which is used to make their comparisons. In this way, a student will determine *how good* the grade obtained in a certain subject is in function of expectations made previously. The concept of loss aversion shows that the effect of 'negative surprises' is stronger than that of 'positive surprises'; in the student context, achieving a worse than expected academic performance would have a much stronger effect on the mood of the student than obtaining a better than expected grade. As mood affects individual's judgement, leading to more favourable (or unfavourable) perceptions of certain conditions, it is relevant to find factors influencing mood and, in turn, perceptions.

More precisely, in this context of 'positive and negative surprises', we investigate the factors that can moderate (reduce or increase) and influence the perceptions of students when forming opinions around their academic performances. Thus, as a new contribution to the field, this study analyses in this realm, the effect of music in the context of the prospect theory. In other words, when students achieve better than expected results, there is a 'positive surprise' leading to greater satisfaction and conversely, worse than expected results imply a 'negative surprise' and less satisfaction -or more dissatisfaction-. And the crucial question at this point is whether music can influence the effect of these surprises -positive or negative- in such a way that the satisfaction (or dissatisfaction) is greater or lesser than it would have been in the absence of music.

Music therapy studies on students show that music can be of great use in improving self discipline, thinking and social interaction (Friedlander, 1994). Moreover, given that music forms part of students' lives (Rury, 2002), stimulation from music is recommended, even more so when we consider the successful results that can potentially be achieved (Hendricks, Robinson, Bradley and Davis, 1999; McIntyre, 2007). The importance of studying the effect of music on the emotions is made clear by the quantity of studies that show that emotions do not just influence physiological features (Bernardi et ál., 2009) but also memory, learning, social behaviour, motivation and cognitive functions (Tucker, 1981; Blaney, 1986). In this sense, as students' affective experiences can be positively moderated by interest (Hidi, Berndorff and Ainley, 2002), not only by *individual interest* -individual predisposition to engage- but also by *situational interest* -generated by certain conditions or stimuli in the environment with immediate affective reactions (Hidi, 1990; Murphy and Alexander, 2000)-, music can be used as a stimulus to arouse this situational interest. In the same vein, Eccles (2005) suggests that the psychological processes linking interest, perceived importance, mastery motivation, perceived competence and actual competence are reciprocal in nature, and that school

contextual characteristics can influence each of these psychological constructs. This means that the study of the 'music-emotion' relationship allows us to look more deeply into the foundations that facilitate the development of useful applications to improve these qualities. At this point it is appropriate to remember, if only as an anecdote, the story studied by Tomatis in which a group of Benedictine monks lost their life force due to the suppression of the Gregorian chants that accompanied their daily activities after the second Vatican council.

Consequently, the objective of this paper is to test and analyze the existence of 'reference dependence' and 'loss aversion' in students' academic performance as well as to examine whether the students' emotional response to their performance can be explained and/or moderated by different musical stimuli.

Prospect theory and the effect of music: hypotheses on academic performance

Experimental research in the field of Psychology shows that, in line with the prospect theory of Kahneman and Tversky (1979), the reactions of people depend on a mentally established reference point; in other words, people tend to compare and evaluate a result using a reference. In this way, we can expect that the satisfaction of a student after discovering the results of an exam will depend not only on the actual result but also on the comparison between the actual result and the expected result¹. The fact that there are students that, even though they have passed, are not happy with a result can be explained by their expectations: although they have reached the minimum requirements to pass the subject, the result is below what they expected. Consequently, we propose the following hypothesis:

H.1. Students are reference-dependent regarding their state of satisfaction with their academic performance.

One of the most notable consequences of this behaviour, and which is proposed in the theory, is 'loss aversion'; a psychological concept that, due to its importance, merits special

⁽¹⁾ Note that this comparison would be more in line with the internal frame of reference proposed by Marsh (1986). However, while this author uses another subject as a point of reference, we utilize -following prospect theory's principles- the expected grade as the reference.

attention (Schmidt and Zank, 2002). This concept implies that the distance of a result from the 'reference point' can be evaluated differently depending on whether the distance is 'positive' or 'negative'; concretely, people are more affected by 'negative surprises' (in our case they would be 'lower than expected results') than by 'positive surprises' ('higher than expected results'). In this sense, the theory predicts that the global effect –on a certain dimension– generated by a 'negative surprise' is greater than the impact of a 'positive surprise' of equal intensity. Consider the following intuitive example relating to students: let's suppose that a student expects a grade of 6 in a subject but actually obtains a 7, and another student, who also expects a 6, obtains a 5. In both cases the difference is of one point, but the question is whether the effect on satisfaction (in the first case) and on dissatisfaction (in the second case) will be the same. As stated in the concept of 'loss aversion', the impact on dissatisfaction of a result one point less than expected is greater than the impact on satisfaction of a result one point higher than expected. Accordingly, we propose the following hypothesis:

H.2. Students are loss-averse regarding their state of satisfaction with their academic performance.

In this context, an interesting application, which is new to this field, is to determine whether a certain musical stimulus can influence or moderate the effects of positive and negative surprises. An increase in 'interest' and 'enthusiasm' among students derived from musical stimuli is shown by Rickson (2003), and Wilson (1991) shows that music is of notable help in realizing appropriate work dynamics in the educational context, making a significant contribution to learning capacity and positively influencing the motivation to learn.

Given that music can awaken any human emotion or feeling, it is crucial to analyse the way in which it can moderate these emotions in students in a learning context. According to Amir (1996), music can influence the attitudes, interests, motivations, emotions or their reactions to a certain stimulus. In this line, music can induce states of mind and behaviours, and alter emotional responses (Goldman, 1998; Martin and Metha, 1997; Thaut, 1989; Thaut and Étoile, 1993).

Consequently, if a 'positive surprise' for a student (getting a higher than expected grade) leads to greater satisfaction, and a 'negative surprise' (lower than expected grade) implies less satisfaction, we can test whether music can moderate the effect of these surprises in such a way that the satisfaction (or dissatisfaction) is higher or lower than it would have been in the absence of music. Given that music can provoke mood changes, certain types of music could induce a state of mind. Along this line, Poch (1999) shows that holding musical recitals when students are arriving foments an emotional mood

and gives them, apart from unconsciously developing musical taste, a predisposition towards studying in the classroom and the ability of positive focussing. Accordingly, Valderrama (2000) shows that slow music can reduce anxiety levels and stimulating music can increase it because if the increased energy generated by the sympathetic nervous system cannot be channelled by some type of activity (dancing, jumping etc.), it will provoke an increased level of excitement and, in turn, greater physical and psychological tension (Valderrama, 2004)². Consequently, certain types of music can moderate -increase or decrease- the effect of certain information on a human being. Based on the above points, the following hypothesis is proposed:

H.3. Music moderates the effect of a given 'surprise' -positive or negative- on the state of satisfaction.

Research Design

Methodology

To reach the study objective a staged experiment is proposed: 1) definition of groups and assignment of types of music; 2) realization of the experiment; and 3) data analysis.

Definition of groups and assignment of types of music

Three groups of secondary 2nd year pupils are used from a school in Alicante (Spain), most of which are between the ages of 13 and 14. Each group is randomly assigned a type of music: the first, classical music (the 4th movement, Adagio, from Divertimento number 15 in B flat major, K.287 of W.A. Mozart); and the second, heavy-metal music («Freak» by the group Dogs on Mars). The third group is the control group, which is not assigned any musical stimulus.

Realization of the experiment

To carry out the experiment, the following five stages are followed: i) The first step is to play the assigned music for a period of approximately five minutes. ii) After this there

⁽²⁾ Paralleling this idea, note that Usher (2009) remarks on the fact that self-efficacy beliefs on academic achievement are informed by emotional and physiological states such as arousal, anxiety, mood, and fatigue.

is a logic test with 10 questions (the students are asked to choose -from six possible answers- the one that they think best continues the series of figures -see Appendix-).
 iii) Then each person is asked to provide a self evaluation, stating their expected result.
 iv) Next, the solutions are provided so that the participants can calculate their actual results.
 v) Finally, while they listen to the same music as before, they are asked if they are satisfied or dissatisfied with the result. The application of music in this experiment is in line with the suggestion of Poch (1999), programming the music before the start of the activity (to predispose the student) and in the final stage (to influence attitude).

Data analysis

To analyse the effect of the differences -positive and negative- between the expected and the actual results ('positive and negative surprises') for the state of satisfaction ('satisfied' or 'dissatisfied'), causal models are used. Concretely, given that the choice between 'satisfied/dissatisfied' is a dichotomous decision, a binomial logit model is used as it detects the influence of an independent variable on the probability of a person choosing a certain alternative (when given two choices).

The state of satisfaction SS_n is defined as a binary random variable that verifies $SS_n = 1$ if the student is satisfied and $SS_n = 0$ otherwise; this variable yields the probability $P(SS_n = 1 | X_n)$. Models to determine the probability of a state of satisfaction given a set of characteristics X_n are derived based on a latent variable SS_n^* that is not observed and verifies $SS_n^* = \alpha + \beta X_n + \varepsilon$, where α and β are unknown parameters to be estimated and ε is an unobserved random variable assumed to be independent and identically distributed as extreme value type I. Accordingly, the above probability is given by the popular logit model $P(SS_n = 1 | X_n) = \exp\{\alpha + \beta X_n\} / (1 + \exp\{\alpha + \beta X_n\})$.

In the empirical application of this study, the state of satisfaction/dissatisfaction of the student is expected to be directly related to the actual grade obtained. Hence, calling AG_n the actual grade of student n , we obtain the following expression:

$$SS_n = \alpha + \beta \cdot AG_n + \varepsilon \quad (1)$$

Parameter β is expected to be positive as the better the actual grade, the greater the satisfaction obtained by the student. However, in order to test the dependence of the 'reference points', which is the basis of the prospect theory, it is necessary to substitute the independent variable of expression (1) (i.e., the 'actual grade' AG_n , which represents an absolute magnitude) with the 'difference between the actual grade AG_n and the expected grade EG_n ', to obtain expression (2):

$$SS_n = \alpha + \beta(AG_n - EG_n) + \varepsilon \quad (2)$$

The existence of 'reference dependence' is evidenced if the specification (2) has more explanatory capacity than the basic equation (expression (1), which only includes the actual grade AG_n as an explanatory variable). In this case, we would expect that parameter β would also be positive, because if a student n obtains a better than expected grade, there will tend to be greater satisfaction (increasing SS_n) and, conversely, if the grade is lower than expected, there will be less satisfaction (reducing SS_n).

In order to observe the effect of the different musical stimuli, three dummy variables are defined and introduced into the previous expression. Concretely, CM_n takes the value of 1 if individual n receives stimulus 'classical music' and zero if not; HM_n takes the value of 1 for the stimulus 'heavy music' and zero otherwise; and NM_n is equal to 1 if the individual receives no music and zero otherwise. In this way, through the above expression (2), we obtain the following expression:

$$SS_n = \alpha + \beta_1(AG_n - EG_n)CM_n + \beta_2(AG_n - EG_n)HM_n + \beta_3(AG_n - EG_n)NM_n + \varepsilon \quad (3)$$

To test for asymmetry in the effects of the 'positive surprises' PS_n and the 'negative surprises' NS_n for student n , in other words, whether there is 'aversion to negative surprises' in line with the prospect theory, it is necessary to define the following variables:

$$PS_n = (AG_n - EG_n)D_p \text{ where } D_1 = 1 \text{ if } AG_n - EG_n > 0 \text{ and } D_1 = 0 \text{ otherwise.}$$

$$NS_n = (AG_n - EG_n)D_2 \text{ where } D_2 = 1 \text{ if } AG_n - EG_n < 0 \text{ and } D_2 = 0 \text{ otherwise.}$$

Placing these variables in expression (2) we obtain:

$$SS_n = \alpha + \beta \cdot PS_n + \gamma \cdot NS_n + \varepsilon \quad (4)$$

where β is the effect of positive surprises on the state of satisfaction/dissatisfaction and γ the effect of negative surprises. 'Aversion to negative surprises' is present if $\gamma > \beta$; in other words, this aversion exists if the parameter associated with 'negative surprises' is greater than the parameter related to 'positive surprises'. In this way, although two surprises -one negative and the other positive- have the same size, the effect of the negative surprise on SS_n will be greater than that of the positive surprise.

To examine the influence of the different musical stimuli we use the three earlier described dummy variables, CM_n , HM_n and NM_n , so that, from the above expression (4), we obtain the following:

$$DSD_n = \alpha_1 + \beta_1 PS_n CM_n + \gamma_1 NS_n CM_n + \beta_2 PS_n HM_n + \gamma_2 NS_n HM_n + \beta_3 PS_n NM_n + \gamma_3 NS_n NM_n + \varepsilon \quad (5)$$

Sample and variables

To reach the proposed research objective information was obtained from a purpose made survey carried out in the first week of June 2009. The initial sample is of 73 individuals, of which three are eliminated for providing incomplete information for some of the questions, leading to a final sample of 70 individuals. The random assignment of the different musical stimuli resulted in the following: 20 receive classical music, 25 heavy music and 25 with no musical stimulus.

To operationalize the proposed models, the following variables are defined: i) Expected grade: a quantitative variable with a range from 0 to 10, which measures, after finishing the test, the grade that the student expects to obtain. ii) Actual grade: a quantitative variable with a range from 0 to 10, which indicates the grade actually obtained in the test. iii) Satisfaction/Dissatisfaction: is measured through a dichotomous variable which takes a value of 1 if the student is satisfied with the result and zero if he or she feels dissatisfied. This variable is the 'dependent variable' in the logit model. iv) Type of musical stimulus: as stated before, three dummy variables are constructed that take a value of 1 if the musical stimulus is 'classical music', 'heavy music' or 'no music', and zero otherwise, for each of the three variables.

Results

The analysis examines the factors that lead students to describe themselves as 'satisfied' or 'dissatisfied' with the result obtained. As a first approximation, the effect of the 'actual grade' on this 'decision' is analyzed. As expected there is a significant positive parameter of the 'actual grade', which implies that as the actual grade increases so does the probability that the student will be 'satisfied' (see Equation 1 in Table 1). In reality, this first estimation is a basic model which we use to make comparisons with the other models. Concretely, Equation 2 shows the effect of the 'difference between the actual and the expected grade', finding that its explanatory capacity is greater than that obtained in Equation 1. This suggests that the introduction of 'reference points' in the analysis -in this case, the 'expected grade'- allows us to explain 'something' in the formation of an individual's satisfaction that the variable 'actual grade' alone is not able to capture. This greater fit capability is observed in all the measurements used: likelihood function, Schwarz and Akaike information criteria and the *pr* of McFadden.

The result that the equation including 'difference between the actual and the expected grade' (Equation 2) has better fit than the equation that 'only includes the actual grade' (Equation 1) is in line with the prospect theory of Kahneman and Tversky (1979) and supports hypothesis 1 that students are reference-dependent regarding their state of satisfaction with their academic performance, in such a way that their reactions depend on a reference point, or in other words, their reactions are the result of comparisons and evaluations of a certain result using a reference point.

Concretely, there is a positive significant parameter of the 'difference between the actual and the expected grade'. Again, this is the expected result, as it implies that a student having obtained a higher than expected grade will tend to classify him/herself as 'satisfied' and, conversely, if the grade is worse than expected there is less probability that s/he will express 'satisfaction' (note that, although the parameter is positive, given that the variable 'difference' is defined as 'actual grade / expected grade', if the actual grade is less than expected, the variable 'difference' will have a negative sign and, therefore, the effect of the product between the parameter -which is positive- and the variable 'difference' -which is negative- will be negative).

TABLE I. Effect of 'gains', 'losses' and the musical stimuli on the feeling of 'satisfied/dissatisfied' (Standard errors in brackets)

Variables	Eq. 1	Eq. 2	Eq. 3	Eq. 4	Eq. 5
Actual Grade (AG_n)	0.711 ^a (0.186)				
Difference between actual and expected grade ($AG_n - EG_n$)		0.876 ^a (0.213)			
(Difference between AG_n y EG_n) x (classical music) ($AG_n - EG_n$) x CM			0.742c (0.295)		
(Difference between AG_n y EG_n) x (heavy music) ($AG_n - EG_n$) x HM			2.013c (0.798)		
(Difference between AG_n y EG_n) x (no music) ($AG_n - EG_n$) x NM			0.776b (0.254)		
Positive surprise (PS_n if $AG_n > EG_n$)				1.051 (0.904)	
Negative surprise (NS_n if $AG_n < EG_n$)				0.849 ^a (0.249)	
(Positive surprise) x (classical music) (PS_n x CM_n)					39.06 (345.00)

(Negative surprise) x (classical music) (NS _n x CM _n)					0.65c (0.324)
(Positive surprise) x (heavy music) (PS _n x HM _n)					40.75 (113.00)
(Negative surprise) x (heavy music) (NS _n x HM _n)					1.905c (0.821)
(Positive surprise) x (no music) (PS _n x NM _n)					0.291 (0.777)
(Negative surprise) x (no music) (NS _n x HM _n)					0.770b (0.286)
Constant	-3.768 ^a (0.930)	0.873c (0.423)	1.055c (0.456)	0.816 (0.504)	0.945d (0.546)
Likelihood	-35.716	-31.76	-29.272	-31.740	-28,449
Scharzw Information Criterion (SIC)	-37.56	-33.61	-32.96	-34.51	-34.91
Akaike Information Criterion(AIC)	-37.72	-33.76	-33.27	-34.74	-35.45
McFadden's ρ	0.234	0.319	0.372	0.319	0,390

a = prob < 0.1%; b = prob < 1%; c = prob < 5%; d = prob < 10%.

Equation 3 of Table 1 shows the results obtained from the introduction of musical stimuli in the analysis. We can clearly see that those that receive 'heavy music' have a much higher parameter than the 'classical music' and the 'no music' groups. These parameters are significantly different at 10% ($p < 0.10$) using the Wald Test. This result implies that the 'heavy music' group reacts more drastically to the comparison between the actual and the expected grade, which supports hypothesis 3 that music moderates the effect of a certain 'surprise' on the state of satisfaction with the surprise.

However, at this point it is crucial to see whether the effect of this 'difference between the actual and expected grade' is symmetrical. In other words, whether a 'positive surprise' (better than expected grade) has the same effect on satisfaction as the same amount of 'negative surprise'. What we are trying to test is the example described in Section 2 of two students that expected a 7 in a subject but one obtains an 8 and the other a 6. In both cases the difference is one point -positive for the first and negative for the second-, but the question is whether this identical difference will have the same effect on the satisfaction of the first student as on the dissatisfaction of the second. According to the property of 'loss aversion', we expect that the impact on dissatisfaction of obtaining one point less than expected will be greater than the impact on satisfaction of obtaining one point more than expected.

Therefore, Equation 4 is estimated, allowing analysis of the possible asymmetric effects of the variable 'difference between the actual and the expected grade'. We find

that the parameter of 'positive surprises' (higher than expected grade) is not significant and that of 'negative surprises' (lower than expected grade) is significant at 0.1% ($p < 0.001$). The finding that the parameter of 'negative surprises' is significantly higher than that of 'positive surprises' supports the idea that students react more intensely to the former than to the latter, which supports the property of 'loss aversion', in line with hypothesis 2, that students are loss-averse regarding their state of satisfaction with their academic performance. As previously indicated, this is one of the most notable properties of the prospect theory, and implies that the distances from the 'reference point' (expected grade) are evaluated differently depending on whether they are 'positive' or 'negative'. In this particular case, the students are more affected by 'negative surprises' (lower than expected grade) than by 'positive surprises' (higher than expected grade), although both surprises have the same intensity (i.e. the positive and negative differences are the same size).

Once demonstrated that there is an asymmetric effect of the positive and negative differences on the probability of a student being satisfied or dissatisfied, we incorporate the effect of the musical stimuli (see Equation 5 of Table 1). It can be seen that, in line with the results of Equation 4, in the case of Equation 5 only the parameters for the 'negative surprises' are significant and positive, with the parameter of 'heavy music' being larger than the rest. This result qualifies that of Equation 3 in that we observe that the 'heavy music' group reacts more intensely to the 'comparison between the actual and the expected grade'. However, the qualification resides in the finding that this only happens for 'negative surprises'; in other words, although the 'classical music' group have a positive parameter of 'negative surprises' (in line with the loss aversion property), it is significantly lower than that of the 'heavy music' group, which implies that 'classical music' acts as a *salve* against these 'negative surprises' and that 'heavy music' acts as an *aggravator*. Positive mood –in this case, generated by classical music– affects individual's judgement, leading to more favourable perception of a situation or, more appropriate for this case, to a *less unfavourable* perception. The same negative impact (obtaining a lower than expected grade) is perceived differently in function of the musical stimulus received: if a student receives 'heavy music' and obtains a 6 instead of the expected 7, the probability of dissatisfaction is higher than if the stimulus had been 'classical music'. This result supports hypothesis 3 that music moderates the effect of a certain 'surprise' on the state of satisfaction with this surprise, in line with the results of Valderrama (2000, 2004) and the argument of Poch (1999) that ending an activity with classical music helps people to focus more positively, while heavy music produces the opposite effect.

Conclusions

People's reactions and responses depend generally on 'reference points', and in the context of students' academic results, it is relevant to observe what their perceptions are, i.e., according to this theory, in order to form an idea of *how good* a grade obtained in a certain subject is a student will not only use the actual grade, but also the actual grade along with a reference point, such as 'the grade I expected to obtain'. There is also wide evidence that music can influence the emotional state of people. Therefore, this paper tests the 'reference dependence' and 'loss aversion' properties in students' emotional response to their academic performance, and the moderating effect of musical stimuli.

The empirical application shows that the probability that a student feels satisfied (or dissatisfied) is best explained by 'difference between the actual grade and the expected grade', which implies a dependence on 'reference points'. However, we find its effect is not symmetrical, as the negative impact of 'negative surprises' has a stronger effect on dissatisfaction than the positive impact of 'positive surprises' on satisfaction. We also find that musical stimuli moderate the effect of a certain 'surprise' on the way in which a person feels -satisfied or dissatisfied- with the surprise.

In terms of the theoretical-practical implications of this study, we can say that generally, the study of the factors that determine the perceptions of students is vital to find the way in which they process information, which will lead to certain behaviour. Likewise, knowing the elements that can favour not only the academic performance of students but also their attitude towards certain results is fundamental. It is important to remember that, as Usher (2009, p. 276) indicates, «students' self-efficacy beliefs can be enhanced when students alter their emotions and thoughts (personal factors), when their teachers use effective classroom structures (environmental factors), and when students improve their self-regulatory practices (behaviour)». Consequently, we can point to the following implications: First, a theoretical implication based on the finding that in all the analyses in this study the «difference between the result and its reference point» has more explanatory capacity than the «actual result itself». Given that this result is based on the idea that people's reactions depend on a reference point, or in other words, that their reactions come from comparisons and evaluations of a certain result using a reference point, this means that, in the context of students' academic results, in the mind of students -consciously or unconsciously- there are 'reference points' so that the variable 'actual grade' itself is not able to collect all the information an individual processes to form a degree of satisfaction. Therefore, it is

important to consider this characteristic in any type of analysis that examines whether a student feels a certain emotion (or not) from a stimulus, and to what degree.

Second, a practical implication that can be applied immediately in the classroom is to consider music to strengthen attitudes: this study demonstrates that musical stimuli can modify the perceptions of a certain result when it is compared to a reference point. In particular, the effects of 'positive surprises' and 'negative surprises' are higher or lower, not only contingent upon the size of these surprises, but also upon to the musical stimulus received. Remember that in the experiment, if the activity ended with classical music the students had a more positive attitude.

Even though small samples are not uncommon in experiments that attempt to detect human behaviors (Kahneman and Tversky, 1979; Harinck, Van Dijk, Van Beest and Mersmann, 2007), the size of the sample used does not allow immediate generalization of the results obtained. Thus, this limitation should trigger new studies with different samples located in distinct geographical areas so that the results could be confirmed.

Finally, for further research remains: 1) in the context of the prospect theory, to analyze whether there is 'diminishing sensitivity' from the finding that the impacts of 'positive and negative surprises' depend on the distance from a 'mid-point'. To be more precise, it would be an analysis into whether the effects produced by 'positive or negative differences between the actual and expected grades' on satisfaction/dissatisfaction are reduced if they are further away from the mid-point of 5: for example, obtaining a 7 when a 6 was expected would have more impact on the degree of satisfaction than expecting a 9 and obtaining a 10. Or, alternatively, obtaining a 3 when a 4 was expected would have a greater effect on dissatisfaction than expecting a 3 and obtaining a 2. The indifference -or the 'couldn't-care-less attitude'- of some students would be a clear reflection of this property: once they have failed, they become more immune to obtaining even worse grades. 2) This article has focused on the 'state of satisfaction' (*whether satisfied or not*) with the grade obtained, so these results could be enriched by analyzing the 'degree of satisfaction' (*how much satisfied*).

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Appendix. Test of the experiment

In each question, choose the answer that you think best continues the series (upper table), from the possible answers 1 to 6 (lower table).

Example

xxxxx	xxxxx	xxx	2
xxxxx	xxxxx	xxx	
xxxxx	xxxxx	xxx	
xxxxx	xxxxx	xxx	
xxxxx	xxxxx	xxx	

1	2	3	4	5	6
xxxxx	xxx	xxxxx	xxxxx	xxx	xxxxx
xxxxx	xxx	xxxxx	xxxxx	xxx	xxxxx
xxxxx	xxx	xxxxx	xxx	xxxxx	xxxxx
xxxxx	xxx	xxxxx	xxx	xxxxx	xxxxx
xxxxx	xxx	xxxxx	xxx	xxxxx	xxxxx

Question I

xxxxx	xxxxx	xxxxx	
xxxxx	xxxxx	xxxxx	
xxxxx	xxxxx	xxxxx	
xxxxx	xxxxx	xxxxx	
xxxxx	xxxxx	xxxxx	

1	2	3	4	5	6
xxxxx	xxxxx	xxxxx	xxx	xxxxx	xxxxx
xxxxx	xxxxx	xxxxx	xxx	xxxxx	xxxxx
xxxxx	xxxxx	xxxxx	xxx	xxxxx	xxxxx
xxxxx	xxxxx	xxxxx	xxx	xxxxx	xxxxx
xxxxx	xxxxx	xxxxx	xxx	xxxxx	xxxxx

Question II

xxxxx	xxxxx	xxxxx	
xxx	xxxxx	xxx	
xxx	xxxxx	xxx	
xxxxx	xxxxx	xxx	
xxxxx	xxxxx	xxxxx	

1	2	3	4	5	6
xxxxx	xxxxx	xxxxx	xxx	xxxxx	xxxxx
xxx	xxxxx	xxxxx	xxx	xxxxx	xxxxx
xxx	xxxxx	xxxxx	xxx	xxxxx	xxxxx
xxxxx	xxxxx	xxxxx	xxx	xxxxx	xxxxx
xxxxx	xxxxx	xxxxx	xxx	xxxxx	xxxxx

Question III

XXXXX	XXXX	XXXXX	
XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	

1	2	3	4	5	6
XXXXX	XXXXX	XXXX	XXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX

Question IV

XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	

1	2	3	4	5	6
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX

Question V

XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	

1	2	3	4	5	6
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX

Question VI

XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	
XXXXX	XXXXX	XXXXX	

1	2	3	4	5	6
xxxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx

Question VII

xxxxx	xxxxxx	xxxxxx	
xxxxx	xxxxxx	xxxxxx	
xxxxx	xxxxxx	xxxxxx	
xxxxx	xxxxxx	xxxxxx	
xxxxx	xxxxxx	xxxxxx	

1	2	3	4	5	6
xxxxxx	xxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxxx	xxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxxx	xxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxxx	xxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxxx	xxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx

Question VIII

xxxxxx	xxxxxx	xxxxxx	
xxxxxx	xxxxxx	xxxxxx	
xxxxxx	xxxxxx	xxxxxx	
xxxxxx	xxxxxx	xxxxxx	
xxxxxx	xxxxxx	xxxxxx	

1	2	3	4	5	6
xxxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxxx	xxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx

Question IX

xxxxxx	xxxxxx	xxxxxx	
xxxxxx	xxxxxx	xxxxxx	
xxxxxx	xxxxxx	xxxxxx	
xxxxxx	xxxxxx	xxxxxx	
xxxxxx	xxxxxx	xxxxxx	

1	2	3	4	5	6
xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx
xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx	xxxxxx

Question X

xxxxx	xxxxx	Xxxxx	
xxxxx	xxxxx	xxxxx	
xxxxx	xxxxx	xxxxx	
xxxxx	xxxxx	Xxxxx	
xxxxx	xxxxx	Xxxxx	

1	2	3	4	5	6
xxxxx	xxxxxx	xxxxx	xxxxx	xxxxx	xxxxxx
xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx

Adapted from <http://www.mensa.es/test/test.html>