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Research article

Motivation and performance in physical education: An experimental test

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Abstract
The purpose of this study was to analyse, experimentally, the relationships between motivation and performance in a lateral movement test in physical education. The study group consisted of 363 students (227 boys and 136 girls), aged between 12 and 16, who were randomly divided into three groups: an experimental group in which an incremental ability belief was induced, another experimental group in which an entity ability belief was induced, and a control group where there was no intervention. Measurements were made of situational intrinsic motivation, perceived competence in executing the task and performance. The results revealed that the incremental group reported higher scores on the situational intrinsic motivation scale. The entity group demonstrated better performance in the first test attempt than the incremental group but, in the second attempt, the performance was similar in the different groups. Perhaps the initial differences in performance disappeared because the incremental group counted on improving in the second attempt. These results are discussed in relation to the intensity with which the teacher conveys information relating to incremental ability belief of the pupil to increase intrinsic motivation and performance.

Key words: Implicit ability beliefs, intrinsic motivation, performance, self-determination theory, students.

Introduction

Physical education classes have, as their principle objectives, the endowment in the pupil of knowledge, ability and attitude necessary to carry out physical activity outside school hours and for the rest of their lives. Following from this it appears fundamental to promote an active and healthy way of life obtained from physical education not only so that the student learns motor skills (to improve their performance) but also that they are motivated and enjoy their lessons (Sallis and McKenzie, 1991). In this area, different theories have been put forward to explain the effect of motivation on behavioural, cognitive and affective consequences in education and physical activity. This study was designed to test, experimentally, the influence of motivation on performance of a physical task under the paradigm of two of the most important contemporary motivational theories: the self-determination theory (Deci and Ryan, 1985; 1991; 2000) and the implicit theories of ability (Dweck, 1999; 2002).

Self-determination theory

Self-determination theory establishes that a series of social factors (teacher influence, friends, parents, the media, etc.) will have an influence on the satisfaction of the basic psychological needs of the pupil (autonomy, competence and relatedness) to develop forms of motivation which are more or less self-determined (intrinsic motivation, extrinsic motivation, and amotivation). Specifically, it is more probable that the student develops intrinsic motivation (action is motivated by the enjoyment obtained during classes) if one fosters student participation and allows autonomy, ensures that the established objectives are reached and fosters group cohesion. However, if his or her basic needs are not satisfied, it increases the probability that the pupil will be motivated extrinsically (the activity is a means to obtain something) or even might be amotivated.

The review by Vallerand (2007) of the hierarchical model of intrinsic and extrinsic motivation in sport and physical activity indicates that intrinsic motivation is related to different positive consequences both at a situational level (in a specific activity, class or training) and a contextual level (in the physical education, sport or exercise context). Therefore, the different studies point out that intrinsic motivation is associated positively with a number of desirable psychological consequences. These include experiencing flow state, vitality, positive affect, enjoyment, satisfaction, interest, concentration, effort, persistence, sportsmanship and adherence to exercise, and negatively with anxiety, burnout, boredom and fatigue. Nevertheless, although there is ample evidence that self-determined motivation is associated with better performance in non-sport tasks (e.g. Burton et al. 2006; Ratelle et al. 2007), limited evidence exists for this hypothesis in sport and physical activity (Vallerand, 2007). Along these lines, there are studies that have shown, experimentally, that inducing intrinsic motivation improves performance in putting in golf (Beauchamp et al., 1996), dribbling in basketball (Simons et al., 2003) and in swimming (Pelletier et al., 2006).

More recent investigations have analysed, longitudinally, from the perspective of self-determination theory, the relationship between different motivational profiles and performance, both in physical education and sport (Boiché et al., 2008; Gillet et al., 2009). Boiché et al. (2008) carried out two studies during a gymnastic cycle in physical education classes with pupils between 10 and 16 years old. Performance was evaluated by three judges from a video recording of the execution of different gymnastic skills after the gymnastic cycle had ended. The results showed that the more self-determined profile (with high scoring in intrinsic motivation and self-determined extrinsic motivation, i.e. identified regulation: participation in classes because they were considered important for

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something) showed better results and grades that the moderate profile (intermediate scores in different types of motivation) and this, in turn, better performance that the non self-determined (with high scores in amotivation and non self-determined extrinsic motivation, i.e. extrinsic regulation: participating looking for an external incentive or recompense or to avoid a punishment). Another similar investigation, but with adolescent athletes (Gillet et al., 2009) found in two studies (tennis and fencing) that the less self-determined profile showed inferior performance during the season than more self-determined profiles.

Although these studies contribute very interesting information they are limited by their correlational nature. They show the relationships which occur between the variables but without demonstrating their causality. Although a self-determined profile has better performance, it cannot be guaranteed that this better performance is as a consequence of more self-determined motivation. Therefore, these studies represent the starting point for the design of experimental studies which could establish causality in the said relationships.

Implicit theories of ability

The implicit ability belief concept was developed by Dweck (1999; 2002), referring to beliefs that individuals have concerning whether certain human attributes are stable or modifiable. This concept has been applied to the sport context by Biddle and colleagues (e.g. Biddle et al., 1999; 2003; Sarrazin et al., 1996), establishing two types of sport ability beliefs: an incremental belief, according to which ability can be improved through training, and an entity belief, which considers ability as something innate that depends on a natural gift.

Incremental ability belief has been related positively with intrinsic motivation in physical education classes and sport (Li et al., 2005; Wang and Biddle, 2001, 2003; Wang et al., 2002). If students believe that their ability can improve, they will probably enjoy physical education more, since they know that if they make an effort, they will manage to improve and this leads to satisfaction. However, if they believe that ability is stable and that, however much they try they are not going to make any progress, they will feel frustrated and amotivated, above all when they try to compare their ability with others' and they do not achieve satisfactory results. It appears plausible to consider that the kind of information given by the teacher relating to ability beliefs (a social situational factor) could influence the motivation of the student to improve or diminish performance. If one teacher implies that ability can always be improved if one works hard and strives for that end, it is probable that the student will be more intrinsically motivated in class. However, if the teacher always reinforces the performance of the better students, has favourites and shows therefore that ability depends on natural talent and that not all can carry out the required tasks in an optimal manner, it is probable that intrinsic motivation will decrease (Ntoumanis and Biddle, 1999). Pioneering experimental studies (Jourden et al., 1991; Kasimatis et al., 1996) have already revealed that the manipulation of ability beliefs could be related to different motivational variables and to performance (self-efficacy, interest, positive affect, skill acquisition). In conclusion, the motivational climate induced by instruction appears to influence the students' achievement behaviour (Simons et al., 2003).

Taking into account that few investigations have analysed, experimentally, the effect of motivation on performance in sporting tasks (Vallerand, 2007), the objective of this study was to add to knowledge about the relationships between these variables. The principal contribution of this work compared to previous studies was the consideration of implicit theories of ability together with self-determination theory to explain performance. An experimental design was put forward within which an attempt to compare how the social factor "information about ability beliefs" affected intrinsic motivation in the pupils to improve their performance in a physical task. Ability beliefs were manipulated with a sample of students that had to perform a lateral movement motor task and situational intrinsic motivation, perceived task competence and performance were measured. It was hypothesised that the group in which an incremental ability belief was implanted would show higher intrinsic motivation, perceived competence and performance of the task.

Methods

Participants

There were 363 students (227 boys and 136 girls), aged between 12 and 16 (M = 13.21, SD = 0.90), who participated voluntarily in this study. The parents were asked for permission for their children to take part in the study, as they were minors. The participants were randomly divided into three groups (121 students per group): One experimental group in which an incremental ability belief was conveyed, another experimental group in which an entity ability belief was conveyed, and a control group where there was no intervention.

Measures

Habitual Physical Activity: The Spanish version (Sarria et al., 1987) of the Habitual Physical Activity Questionnaire by Baecke et al. (1982) was used to measure the participants' habitual physical activity. Physical exercise in leisure time was assessed by four questions. The first of them referred to the type of sport or sports done, the weekly frequency and the months in which this takes place. The score of this first question was calculated with the following formula: Modality 1 (Intensity x Time x Proportion) + Modality 2 (Intensity x Time x Proportion). Different coefficients were allocated to calculate this formula, depending on the sport done, the weekly hours and the months in which this takes place (see Ainsworth et al., 2000; Florindo and Latorre, 2003). The other three questions assessed the level of physical exercise in leisure time (e.g. "during leisure hours, I practice sports or physical exercise") using a Likert scale ranging from 1 (*never*) to 5 (*very often*). To calculate the final score, the first question's score was reconverted into values from 1 to 5 and the mean of the four questions was calculated. The questionnaire obtained a Cronbach's alpha value of .63 in this study.

General Perceived Competence: The sport competence factor of the Spanish version (Moreno and Cervelló,

2005) of the Physical Self-Perception Profile (Fox, 1990; Fox and Corbin, 1989) was used. There were six items (e.g. "I think I am always one of the best when taking part in sport activities"), which, headed by the statement "When I do physical activity…" were answered on a Likert-type scale from 1 (*totally disagree*) to 4 (*totally agree*). A Cronbach's alpha value of .80 was obtained in this study.

Performance: The lateral movement test from the KTK (body coordination test for children) by Kiphard and Schilling (1974) was used. The task consisted of moving some boards (25 x 25 x 1.5 centimetres) laterally as many times as possible in 20 seconds. Students had to get onto a board with another board on their left. They had to pick up the board on their left with both hands and put it on their right and then get on it. They had to repeat this process for as long as the test lasted. The number of movements of the body and board were evaluated. One point was obtained every time the board was placed on the floor and another two points when the students stood on the board. The points from two attempts were recorded and added together.

Situational Intrinsic Motivation: The intrinsic motivation factor of the translation into Spanish of the Situational Motivation Scale (SIMS, Guay et al., 2000) was used to evaluate the students' intrinsic motivation whilst performing the motor task. This factor, headed by the statement "Why did you take part in this activity?" consisted of four items (e.g. "because this activity is fun") which were answered with a Likert scale from 1 (*does not correspond at all*) to 7 (*corresponds exactly*). The intrinsic motivation factor showed a Cronbach's alpha value of .88 in this study. As the instrument had not yet been validated for the Spanish context, a confirmatory factor analysis was performed. The results showed acceptable fit indices: χ^2 (2, N = 363) = 5.60, p > 0.05; $\chi^2/d.f.$ = 2.80; CFI = 0.99; IFI = 0.99; TLI = 0.99; RMSEA = 0.07; SRMR = 0.01. The standardised regression weights were 0.83, 0.81, 0.80 and 0.80.

Perceived Task Competence: Three items from the sport competence factor of the Spanish version of the Physical Self-Perception Profile were used, which were adapted to evaluate perceived competence in the task performed. The three items showed a reliability of .78.

Design and procedure

Prior to performing the lateral movement task, the participants responded to a questionnaire in which they were asked for their habitual physical activity and their general perceived competence. Next the main researcher explained how to complete the motor task. After the task had been explained, the researcher tried to manipulate the participants' ability beliefs. The experimental-incremental group was given the following information:

"Recent studies have shown that people develop their sport abilities through learning, practice and training. Therefore, sport ability can always be improved upon by suitable practice. It is not true that there are people born with a special gift for sport. For example, at Real Madrid, Raúl, who was at a low level, managed to improve thanks to hard training and effort, because Raúl trains many hours a day. The lateral movement test you are going to do requires practice. Therefore, your second attempt is going to be much better than your first".

For the experimental-entity group the prior information was: *"Recent studies have shown that there are people who are born with a certain gift for some sports, and, therefore, this gift is innate and difficult to modify. For example, Leo Messi was born with a special ability for football and even though he is only 20 years old he is a phenomenon. The lateral movement test you are going to perform requires, in particular, good coordination, balance and fast movement to do it well. It is difficult to change these abilities even with training and practice. Some people are just better than others. Even though you have two attempts, the second will be the same as the first because research has shown that ability cannot be improved upon".*

The control group was only told how to perform the task and no further initial information was provided. After performing the two attempts, all the students responded to a questionnaire in which they were asked for their perception of competence and their intrinsic motivation in the task.

For the manipulation footballers were used as models because, in Spain, men's football is the most popular sport and equally as many adolescent girls as boys know the best players in the league. Perhaps it might have been interesting to use female models for the girls participating in the study but, unfortunately, female sport is not very popular in Spain. Using male footballers guaranteed that all the participants knew these sportmen and their qualities and therefore the intervention would be more effective.

Data analysis

First a MANOVA was performed to check that there were no significant differences among the three groups in age, gender, level of physical activity and general perceived competence. After checking that the groups were homogenous, the effects of the intervention were analysed. A MANOVA was performed to analyse whether there were any significant differences in the score of each of the attempts at the lateral movement test, in situational intrinsic motivation and in perceived competence in that task among the groups. The analyses were conducted with the statistical package SPSS 15.0.

Results

Preliminary analysis

A MANOVA was performed in which the (experimental-incremental, experimental-entity, control) group was entered as a fixed factor and age, gender, habitual physical activity and general perceived competence were entered as dependent variables. The results showed that there were no significant differences among the three groups (Wilks' Λ = .97, F(8,714) = 1.31, p > 0.05). Later univariate analyses showed that there were no significant differences in age (F(2,360) = 1.93, p > 0.05), or in gender (F(2,360) = .85, p > 0.05), or in physical activity (F(2,360) = 0.75, p > 0.05), or in general perceived competence (F(2,360) = 0.87, p > 0.05), so there were three

Table 1. Distribution of groups by gender. Mean (±SD) for the selected variables.

Variables	Incremental	Entity	Control
Gender	70 boys, 51 girls	78 boys, 43 girls	79 boys, 42 girls
Age	13.33 (1.01)	13.11 (.92)	13.18 (.74)
Physical activity	3.02 (.68)	3.09 (.72)	3.13 (.69)
General perceived competence	2.65 (.60)	2.56 (.64)	2.66 (.62)

homogenous groups at the start. In Table 1 one can see mean and standard deviation in the variables age, physical activity and general perceived competence and the distribution of the groups by gender.

Intervention effects

A MANOVA was performed in which the group was the fixed factor and the score in the lateral movement test, intrinsic motivation and perceived competence in the task were the dependent variables. The results showed that there were significant differences among the three groups (Wilks' $\Lambda = 0.91$, $F(10,712) = 3.43$, $p < 0.01$). To be precise, the later ANOVAS (Table 2) demonstrated significant differences in the first attempt at the lateral movement test ($F(2,360) = 3.28$, $p < 0.05$) and in situational intrinsic motivation ($F(2,360) = 10.58$, $p < 0.01$). No significant differences were found either in the second attempt at the lateral movement test, or in the total of the two attempts, or in perceived competence in the task. Tukey's post hoc tests showed that there were significant differences in the first attempt at the lateral movement test between the experimental-incremental group and the experimental-entity group ($p < 0.05$), with the first group having a lower score ($M = 31.73$) than the second ($M = 33.84$). There were significant differences in intrinsic motivation between the experimental-incremental group and the other two groups ($p < 0.01$ for the experimental-entity group and for the control group). The experimental-incremental group obtained a higher score in situational intrinsic motivation ($M = 5.27$) than the experimental-entity group ($M = 4.79$) and the control group ($M = 4.51$).

Discussion

The objective of this study was to analyze, experimentally, the relationship between motivation and performance in an exercise of lateral movement in physical education, using, as a theoretical base, self-determination theory and implicit theories of ability. To the date, few experimental studies have analyzed the effect of self-determined motivation on performance in physical activity and sport (Vallerand, 2007). Previous investigations have manipulated ability beliefs to analyse their influence on various motivational variables and performance (e.g. Jourden et al., 1991; Kasimatis et al., 1996; Spray et al., 2006), but not from the point of view of self-determination theory. The objective of this research was to modify the ability beliefs of participants and test the effects of this intervention. However, in this study the information transmitted about the ability beliefs was considered a situational social factor that could affect the intrinsic motivation and performance of the participants.

The results showed that the group in which an incremental ability belief was induced showed more situational intrinsic motivation than the group in which an entity belief was induced and the control group. Furthermore, significant differences were found in performance in the first attempt at the lateral movement test, with the entity group having a higher score than the incremental group. Nevertheless, these differences reduced significantly in the second attempt and in the final result, which was represented by adding the two attempts together. Neither were significant differences found in perceived task competence among the three groups.

These results indicate that promotion of an incremental belief produced an increase in intrinsic motivation whilst performing the task. Furthermore, it seems that this incremental belief and greater intrinsic motivation made the students trust they would improve their performance in the second attempt at the lateral movement test. These findings are in line with other experimental studies which found that inducing intrinsic motivation in different sporting tasks improved performance (Beauchamp et al., 1996; Pelletier et al., 2006; Simons et al., 2003). However, in the group in which an entity belief had been induced, the improvement in the second attempt was less, since they had been convinced that they were not going to improve however much they tried. The adolescents in the entity group probably tried to perform better than the others (ego involvement) in the first attempt since they believed that they could not improve. This might explain why they obtained a higher score in the first attempt. With regard to the incremental group, they thought they would be able to perform better in the second attempt, and this meant that the differences with the entity group were eliminated in the second attempt and in the final performance. Spray et al. (2006) demonstrated in a similar physical education study that the entity group showed more ego involvement in a golf putting task, whilst the incremental group was more task-involved.

Table 2. Differences between the three groups in lateral movement, situational intrinsic motivation and perceived task competence.

Variables	Incremental	Entity	Control	*F*	Partial η^2
Lateral movement-Attempt 1	31.73 (6.57)	33.84 (6.11)	32.19 (7.49)	3.28*	.02
Lateral movement-Attempt 2	35.27 (6.87)	36.78 (6.34)	35.23 (7.57)	1.94	.01
Lateral movement-Total score	66.92 (12.87)	70.62 (11.87)	67.42 (14.55)	2.82	.01
Intrinsic motivation	5.27 (.96)	4.79 (1.62)	4.51 (1.17)	10.58**	.06
Perceived competence	2.69 (.54)	2.61 (.71)	2.66 (.71)	.46	.00

* $p < 0.01$, ** $p < 0.001$

In short, incremental belief produces an increase in intrinsic motivation, which is reflected in an increase in performance when a test requires several attempts. This is the case in any sport learning task implemented in physical education. Therefore it is fundamental that teachers of physical education indicate, when initiating tasks, to promote perceptions that it is always possible to improve. It is necessary to take advantage of all moments of interaction with pupils to make them see that, if they make an effort, get involved and work sufficiently hard, they will achieve the specified objectives. It would be useful for the teacher to point out that, although there are different levels of ability, all pupils can improve their level of play and be good at something. Equally, when giving feedback, it is important, as well as correcting bad execution, to encourage further attempts. Many times the physical education teacher comes across pupils who say "Sir, I can't do this, I'm no good at it" and should be convinced that they really can do it. In this way one may hope to augment their intrinsic motivation and their performance.

If the students believe that their ability will improve, they will participate motivated, no doubt, by the fact that acquiring knowledge and improving performance is fun. Such participation without any external pressures and for enjoyment seems to make adolescents view their performance of physical activities and sport as being more effective. This is most likely due to the fact that their effort and persistence are greater (Ferrer Caja and Weiss, 2000), which results in a better performance. Furthermore, as the reason for the action is internal, the individual usually feels less anxious (Ryan and Conell, 1989) and, therefore, will perform better than when there are extrinsic pressures.

Nevertheless, we need to bear in mind that there were no significant differences in final performance and perceived task competence between the entity group and incremental group in the present study. This result is probably due to the fact that adolescents generally demonstrate a high incremental ability belief (Spray et al., 2006) and it is difficult to change this with a short intervention. If the task implemented had required more attempts, and the intervention on ability beliefs had been longer, the incremental group may have performed better than the entity group. In fact, if we take into account the postulates of the hierarchical model of intrinsic and extrinsic motivation (Vallerand, 1997), motivation experienced at a situational level could have an influence on contextual motivation. That is to say that repeated situations in which one can induce an incremental ability belief could lead pupils to improve their contextual motivation towards physical education and their performance in the course. It would be interesting if future studies analysed how the increase in incremental ability belief, self-determined motivation and performance in physical education classes might be reflected in a greater commitment to the practice of physical activity in adolescence.

It is important to identify the limitations in the study. Firstly, it is necessary to point out that the implicit ability beliefs of the pupils was not measured and perhaps it would have been useful to do so to obtain clearer information (for example to know if both groups really revealed a high incremental belief). However, the objective of the study was not so much to modify ability beliefs as to see how information transmitted about this belief (social factor) could affect intrinsic motivation and performance. Secondly, no significant differences exist between the groups in regard to performance and perceived competence and although we have tried to explain this fact, there could be other reasons for this absence of difference. In this regard, it would be interesting for future research to design longer interventions to try to check the effects of prompting of incremental ability beliefs on different forms of motivation established by the self-determination theory, and on sport skill learning and performance. The use of multilevel analyses into growth designs could produce a more global explanation of the interaction between contextual and personal variables and the consequences related to this interaction (Goldstein and Blatchford, 1998; Goldstein and McDonald, 1988). Finally, it would be a good idea for future investigations to use physical and sport tasks that are more difficult than the one used in this research, which would be more applicable to real situations.

Conclusion

This study has demonstrated that if a physical education teacher instills the belief that ability can improve, this was associated with an increase in intrinsic motivation. In addition, this inducement of an incremental ability belief and increase in intrinsic motivation could result, in the medium to long term, in better performance from the pupil in tasks set up in class. These results must be considered bearing in mind the importance of motivation and learning in physical education classes in the promotion of active and healthy life styles.

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Key points

- The incremental group showed more situational intrinsic motivation.
- The entity group showed higher performance in the first test attempt, but significant differences disappeared in the second attempt.
- It seems that this incremental belief and greater intrinsic motivation made the students trust they would improve their performance in the second attempt at the lateral movement test.

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