

Article

Adaptation and Validation of the Mind-Wandering Questionnaire (MWQ) in Physical Education Classes and Analysis of Its Role as Mediator between Teacher and Anxiety

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Abstract: Physical education (PE) classes are one of the primary means of adopting healthy lifestyles and contribute greatly to personal well-being. However, it is necessary that students pay attention and do not enter a mind-wandering state as this can be negative for the purposes of PE classes. Therefore, we adapted and validated the Mind-Wandering Questionnaire (MWQ) to the Spanish PE context and analyzed the influence of the teacher on this new variable. Two independent samples of high school students between the ages of 13 and 19 participated in the study. In order to assess the psychometric properties of the MWQ, various analyses were carried out. The results of the confirmatory factorial analysis (CFA) provided support for the structure of the questionnaire. The structure of the model was gender-invariant. The Cronbach alpha value was higher than 0.70 and showed an adequate level of temporal stability. In addition, we present a second study in which high school students between the ages of 13 and 19 participated, and which are independent of the first study. The analyses in this study were mainly based on structural equation modelling, and demonstrated the teacher's influence on mind-wandering and showed that mind-wandering acted as a predictor of anxiety in high school students. The results of this study provided evidence of the reliability and validity of the MWQ in the Spanish PE context.

Keywords: education; mind-wandering; validation; physical education

1. Introduction

In many studies, physical education (PE) classes have been shown to have a significant influence on the affective, physical, and psychological development of students, as well as on the adoption of healthy lifestyle habits [1,2]. However, students are required to pay attention, maintain their focus and get involved in PE classes [3] in order to generate a series of adaptive behavioral responses such as the adoption of active habits of physical activity and/or sports in their free time, and even greater academic performance [4]. However, at times students often enter into a state of "mental vagrancy" during classes called mind-wandering, which implies a loss of concentration or lack of awareness of the task being performed, thus preventing the assimilation of information [5]. Therefore, it is necessary to have a scale in the Spanish context, which evaluates mind-wandering in the field of PE classes in order to measure the state of thought with respect to the activity that is being carried out.

According to various studies, adults are absorbed in their own thoughts between 30 and 50% of their daily life, which has a considerable impact on their quality of life since they are distracted from

the events occurring in their environment [6]. For teenagers, this percentage is around 40% of the time they spend in class, seriously damaging their academic performance and personal development [7]. Traditionally, the area of physical education has been considered mostly procedural, that is, linked to the acquisition of physical skills. However, physical education has been shown to involve cognitive processes since the acquisition of physical and cognitive skills is linked to interaction between peers, the environment, and one's own abilities. However, students of physical education, as happens in other areas of education, sometimes remain absorbed in their own thoughts that are external to the activity they are involved in when they are bored or have anxiety [8]. These external thoughts are generally linked to emotional distress and worries that enter the minds of students while they participate or are present in physical education classes, distracting them from the class [9]. This often has a negative effect on cognitive development, academic performance, and well-being among students [10].

Various studies on mind-wandering have been carried out in experimental cohort classroom-laboratories where the strange variables were controlled with two groups of students, one control group and experimental one, to which they were submitted to multiple factor distractors of the activity they were carrying out (e.g., Poerio, Totterdell, and Miles, [11]; Risko, Anderson, Sarwal, Engelhardt, and Kingstone, [12]; Smallwood, Fishman, and Schooler, [13]; Szpunar et al. [5]). These studies have shown that when the mind wanders, the awareness of external events is reduced, and this prevents the internalization of information by disadvantaging learning, which subsequently leads to poor academic performance [12]. Furthermore, mental distraction prevents the successful coding of environmental information, and this relative absence of facts puts the individual at a disadvantage when the general models necessary to understand and assimilate the information are formed [14]. The same occurs in relation to the reading of a text, when those students who enter into a state of mind-wandering, have as a consequence a processing or absence of basic information of the text, which supposes a disadvantage at the time of understanding the text deeply, affecting the codification of the information that leads to deeper deficits of analysis of the complete text [15].

In the same way, the role of the teacher is also fundamental for students in order to be more attentive to the explanations of the teacher and to the information that involves them [16]. In this sense, from the self-determination theory, it is suggested that teachers can interact with their students through two very different interpersonal styles that support autonomy versus control [17]. The first style refers to the promotion of one's own initiative, the mental and physical self-development of the student [18]. On the contrary, a controlling style where external pressures, the use of coercive means, impositions, etc., are perceived by students as the origin of their behavior, undermining their own initiative, effort, and personal self-knowledge [19]. For this reason, different studies have shown how support for autonomy fosters the development of a series of adaptive behaviors among which is the increase of attention in class and the use of metacognitive strategies [20,21].

Therefore, Mrazek, Phillips, Franklin, Broadway, and Schooler [22] created and validated the Mind-Wandering Questionnaire (MWQ) in order to provide researchers with a direct tool to quickly assess mind-wandering levels and facilitate a fuller understanding of inattention among young people. The authors involved 663 students from the University of Santa Barbara, California, with an average age of 19.48. In order to validate the scale, the authors conducted a reliability analysis through Cronbach's alpha that gave a score of 0.85, in addition to further testing internal consistency, they examined the inter-item correlation yielding good correlations (Mean: 0.54, Minimum: 0.44, Maximum: 0.68). Since the scale showed high internal reliability, they then examined the homogeneity of the scale, i.e., the degree to which items evaluate a single underlying factor analysis. The analysis of the main factor of the responses to the five items revealed a significant component with its own value > 1 (value: 3.58), representing 63.16% of the total variance. Each of the five scale items had a high load towards this unique factor called mind-wandering (0.71, 0.74, 0.85, 0.84, 0.82).

Experimental Overview

Study 1 aims to assess the psychometric properties of the Mind-Wandering Questionnaire (MWQ) in order to validate it and adapt it to the Spanish context of PE classes. For this purpose, a confirmatory factorial analysis will be performed and its internal consistency, temporal stability, and gender invariance analysis will be analyzed. Study 2 aims to assess through a structural equation modelling as according to the role perceived by students that the teacher adopts during their classes inferred on mind-wandering and this, in turn, on anxiety. In this way, we intend to show evidence of validity of criterion for the MWQ-PE relating the scores of Mind-Wandering with respect to anxiety of students during PE classes.

2. Method: Study 1

2.1. Participants

The study included the participation of 604 secondary school students, 321 boys and 283 girls, between 13 and 19 years of age ($M = 15.7$; $SD = 1.43$) from two schools in a province of Andalusia. In order to assess the temporal stability of the instrument, a separate independent sample of 252 secondary education students (129 boys and 123 girls), who ranged in age from 13 to 19 years ($M = 15.21$; $SD = 1.67$) was used. These students completed the instrument on two occasions, with an interval of two weeks.

The sampling used was nonprobabilistic and accidental, depending on the educational centers and students to which access was obtained.

2.2. Instruments

Mind-Wandering. The instrument utilized was the Mind-Wandering Questionnaire (MWQ; [22]). This questionnaire displays the heading "In my PE classes..." The scale features 5 items (e.g. I do the exercises without paying attention) with a single factor. The students responded based on a Likert scale from 1 (almost never) to 6 (almost always). The final version is shown in the Appendix A (Table A1).

2.3. Procedure

In order to validate the MWQ to the Spanish context, the reverse translation strategy was used [23]. The process consists of a group of expert translators translating the original questionnaire into Spanish and subsequently another group translated it into its original language. The elaborated version is then analyzed by three psychologists, experts in PE [24], so as to ensure that the items obtained were well designed to measure the construct it wanted to measure, without losing the original meaning.

Once the Mind-Wandering Questionnaire had been obtained, the heads of the participating school were contacted, who, in turn, contacted PE teachers, who were also informed of the objective of the research and asked for their collaboration. Given that most of the students were underage, their parents or guardians were asked to fill out and sign an authorization document before the scales were applied. The questionnaire was administered under the supervision of a professional surveyor from the research group who explained the information and answered any questions that arose during the process. The questionnaires were answered anonymously. This study was carried out in accordance with the recommendations of the American Psychology Association. The entire experiment was conducted in accordance with the Declaration of Helsinki. Ethics approval was obtained from the Research Ethics Committee of the University of Almeria, Spain (Ref. UALBIO 2019/014). The estimated time to complete the questionnaires was around 15 min.

2.4. Data Analysis

An assessment of the psychometric properties of the Mind-Wandering Questionnaire towards PE classes (MWQ-PE) in the Spanish context was conducted through various statistical processes. As a

first step, a confirmatory factorial analysis (CFA) was conducted to test the structure of the model. Subsequently, multigroup analysis was conducted to assess invariance relative to gender, in order to determine whether the questionnaire is understood equally by both male and female students. Finally, all descriptive statistics were examined and the internal consistency of the subscale was assessed through Cronbach's alpha statistic. Temporal stability was assessed through intraclass correlations (ICC). The statistical packages SPSS 23.0 and AMOS 19.0 were used for the data analysis.

Given the high value for the Mardia coefficient (67.54) in the CFA, the maximum likelihood estimation method was used along with the bootstrapping procedure. The estimators were not affected and were therefore considered robust [25]. Aiming to accept or reject the tested model, a set of fit indices were taken into consideration: χ^2/df , CFI (Comparative Fit Index), IFI (Incremental Fit Index), RMSEA (Root Mean Square Error of Approximation) plus its 90% confidence interval (CI), and SRMR (Standardized Root Mean Square Residual). Given that χ^2 is very sensitive to sample size [26], the value of χ^2/df was also considered with values less than 5.0 considered to be acceptable [27]. The incremental fit indices (CFI and IFI) revealed a good fit with values equal to, or exceeding 0.95 [28], while the RMSEA and SRMR error indices are considered acceptable if their values are less than 0.08 [29,30].

2.5. Results

2.5.1. Confirmatory Factorial Analysis

The fit indices of the model (Figure 1) revealed appropriate fit indices: χ^2 (5, N = 604) = 17.37, $p < 0.01$; $\chi^2/df = 3.47$; CFI = 0.99; IFI = 0.99; RMSEA = 0.064 (90% CI = 0.043–0.088); SRMR = 0.042. Standardized factor loadings were statistically significant ($p < 0.001$) and ranged between 0.88 and 0.93.

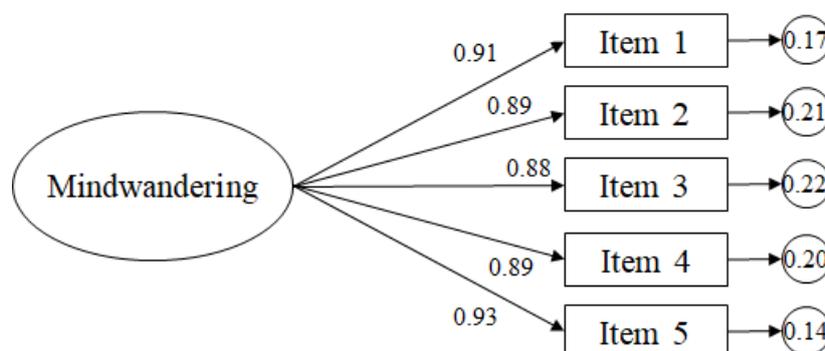


Figure 1. Confirmatory factor analysis of the Mind-Wandering Questionnaire of Physical Education (MWQ-PE). The ellipses represent the factors and the rectangles represent the specific items. Residual variances are presented in the small circles.

2.5.2. Analysis of gender invariance

As shown in Table 1, a multigroup analysis was conducted to determine whether the proposed model is invariant with respect to gender. Table 1 displays the various fit indices for each of the models. There were no significant differences between model 1 (unrestricted model), model 2 (the weighted mean invariance model), and model 3 (the invariant structural covariance model). On the other hand, the results did show significant differences between model 1 and 4 (the mean residual invariant model). The lack of significant differences between model 1 and 2 attained the minimum criteria for acceptance of invariance relative to gender [31].

Table 1. Analysis of gender invariance.

Models	χ^2	df	χ^2/df	$\Delta\chi^2$	Δdf	CFI	IFI	RMSEA (CI 90%)	SRMR
Model 1	22.10	10	2.21	-	-	0.99	0.99	0.052 (0.022–0.082)	0.034
Model 2	26.52	14	1.90	4.42	4	0.99	0.99	0.045 (0.017–0.071)	0.035
Model 3	32.67	15	2.18	10.57	5	0.98	0.98	0.052 (0.027–0.076)	0.059
Model 4	38.27	20	1.91	16.17 **	10	0.98	0.98	0.045 (0.023–0.067)	0.053

** $p < 0.01$. Note. Model 1 = unrestricted model; Model 2 = the weighted mean invariance model; Model 3 = invariant structural covariance model; Model 4 = mean residual invariant model. CFI = Comparative Fit Index; IFI = Incremental Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual.

2.5.3. Descriptive Statistics and Reliability Analysis

The average mind-wandering score was 2.35. Cronbach's alpha statistic was used to assess internal consistency and the associated alpha value for mind-wandering was 0.92 for mind-wandering, while average variance extract revealed a value of 0.81.

With regard to the analysis of temporal stability, an independent sample was used in which intraclass correlation coefficients (ICC) and confidence intervals (CI) were examined. Temporal stability was supported for mind-wandering 0.81 (CI = 0.75–0.87).

3. Method: Study 2

3.1. Participants

The participants in this study were 596 secondary education students (311 boys and 285 girls). These participants were between the ages of 13 and 19 (M = 15.4; SD = 1.37) and belonged to various schools in a province of Almeria. The sample used was not accidental probabilistic, depending on those educational centers and students to which access was obtained.

3.2. Instruments

Perceived autonomy support. The instrument utilized was the Spanish version of Perceived Autonomy Support Scale for Exercise Settings validated by Moreno et al. [32] for PE in the Spanish context. This scale is comprised of 12 items that evaluate one single factor of autonomy support. The questionnaire is based on a Likert scale from 1 (totally disagree) to 7 (totally agree).

Psychologically Controlling Teaching. The instrument utilized was the Psychologically Controlling Teaching Scale (PCTs; [33]) validated and adapted for the PE context in Spain Trigueros, Aguilar-Parra, Cangas and Gonzalez-Santos [34]. The questionnaire is presented under the heading "My PE teacher..." and includes 7 items (e.g. makes me feel guilty when I disappoint him) that evaluate one single factor. The questionnaire is based on a Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Mind-Wandering. The instrument utilized was the Mind-Wandering Questionnaire (MWQ; [22]). This questionnaire displays the heading "In my PE classes ..." The scale features 5 items (e.g. I do the exercises without paying attention) with a single factor. The students responded based on a Likert scale from 1 (almost never) to 6 (almost always). The final version is shown in the Appendix A (Table A1).

Anxiety. In order to measure anxiety, we utilized the factor of the same name taken from the Emotions in the PE Questionnaire by Trigueros et al. [35]. The questionnaire is presented under the heading "During PE classes ..." and includes 34 items divided among eight factors, four of which have positive valence and four with negative valence. More specifically, the embarrassment factor is comprised of four items (e.g. I am concerned if I will be able to understand/do the exercises). The questionnaire is based on a Likert scale from 1 (strongly disagree) to 7 (strongly agree).

3.3. Procedure

Once the Mind-Wandering Questionnaire had been validated, the heads of the participating schools were contacted again. Prior to beginning the survey process, the schools and students were informed of the study's objectives. The students were under-age, a written authorization was requested from both the school and the parents of the participants. The questionnaire was administered under the supervision of a professional surveyor from the research group who explained the information and answered any questions that arose during the process. The questionnaires were answered anonymously. This study was carried out in accordance with the recommendations of the American Psychology Association. The entire experiment was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Research Ethics Committee of the University of Almeria, Spain (Ref. UALBIO 2019/014). The estimated time to complete the questionnaires was around 15 min.

3.4. Data Analyses

The descriptive statistics, bivariate correlations and reliability analyses were conducted in order to analyze the relationships between the different study variables. In addition, an SEM was conducted in which the perception of support for autonomy and control of the students over mind-wandering was analyzed, and the latter over the anxiety experienced during classes in order to know the predictability of the questionnaire validated in study 1. For data analysis, the statistical packages SPSS v23.0 (IBM, Armonk, NY, USA) and AMOS v19.0 (IBM, Armonk, NY, USA) were used.

With the objective of accepting or rejecting the tested model (Figure 2), a set of fit indices were taken into consideration: χ^2/df , CFI (Comparative Fit Index), IFI (Incremental Fit Index), RMSEA (Root Mean Square Error of Approximation) plus its 90% confidence interval (IC), and SRMR (Standardized Root Mean Square Residual). Given that χ^2 is very sensitive to sample size [26], χ^2/df was utilized, where values below 5 were considered acceptable [27]. The incremental indices (CFI and IFI) with values equal to or greater than 0.95 [28], while error indices (RMSEA and SRMR) are considered acceptable with values equal to or less than 0.08 [29,30].

3.5. Descriptive Statistics and Reliability Analysis

The descriptive statistics, bivariate correlations, average variance extract, and reliability analysis obtained using Cronbach's alpha can be observed in Table 2. The highest average score was obtained for autonomy support. In contrast, the lowest average score was obtained for controlling psychology.

In addition, the reliability analysis obtained using Cronbach's alpha and average variance extract were conducted to show evidence of the reliability of the different scales (see Table 2). The reliability analysis revealed ranging from 0.94 for mind-wandering to 0.81 for anxiety.

Table 2. Descriptive statistics and bivariate correlations.

Variables	M	SD	Range	α	AVE	1	2	3	4
1. Controlling Psychology	1.72	1.01	1–5	0.83	0.68		−0.52**	0.38**	0.47**
2. Perceived Autonomy Support	4.51	1.21	1–7	0.82	0.75			−0.40**	−0.53**
3. Mind-wandering	2.15	1.19	1–6	0.94	0.61				0.51**
4. Anxiety	2.25	1.39	1–7	0.81	0.85				

Note: ** $p < 0.01$; M = Mean; SD = Standard Deviation; α = alpha de Cronbach; AVE = Average Variance Extract.

3.6. Model of Structural Equations

Prior to testing the hypothesized model using an SEM and analyzing the relationships existing between the variables belonging to the model, the number of latent variables was reduced, whereby each one had at least two indicators due to the complexity of the model [36]. Thus, half of the first

items of each subscale were averaged to form the first block of items, and the second half of items were averaged to form the second block of items, and so on until the last block. This proposal turns out to be more reliable, as they tend to be distributed normally, in addition to halving the ratio of the number of variables measured in the model.

The hypothesized model for the predictive relationships (Figure 2) shows that the fit indices were: χ^2 (16, N = 596) = 60.22, $\chi^2/df = 3.76$, $p < 0.001$, IFI = 0.95, CFI = 0.95, RMSEA = 0.067. (90% CI = 0.065–0.078), SRMR = 0.049. The results fit the established parameters, meaning that the proposed model can be accepted as suitable [29]. Similarly, the contribution of each one of the factors to the prediction of other variables was examined by means of standard regression weights.

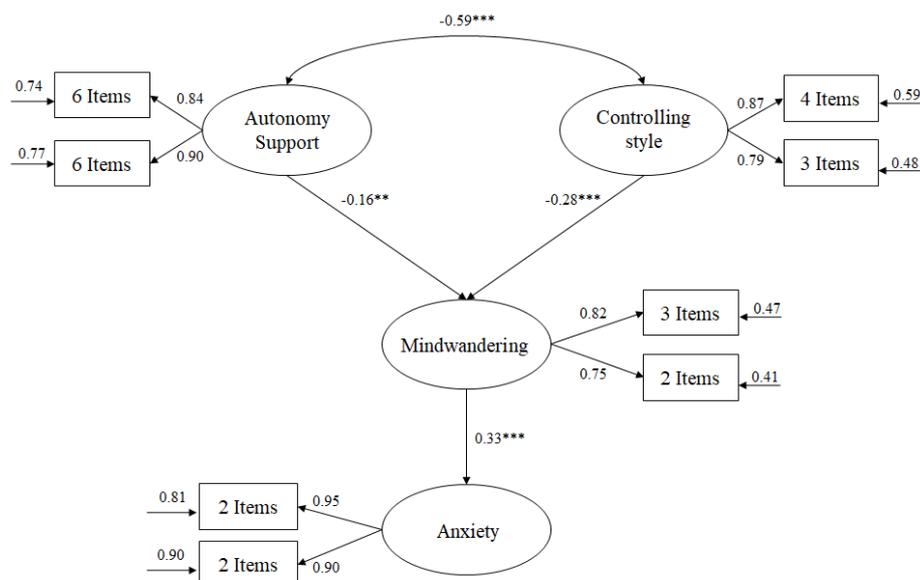


Figure 2. Of SEM showing the relationships between the different variables. All parameters are standardized and statistically significant. The variances explained are shown above the small arrows. Note: *** $p < 0.001$; ** $p < 0.01$.

4. Discussion

4.1. Discussion of Study 1

The purpose of study 1 was to assess the psychometric properties of the Mind-Wandering Questionnaire (MWQ) in order to validate it and adapt it to the Spanish context of PE classes. The results revealed that MWQ-PE has an appropriate factorial structure because the parameters are above the established cut-off points [27,28,30]. In addition, Cronbach's alpha analysis revealed that mind-wandering is a reliable factor given that its score was above 0.70, this being the lowest criterion [37]. The analysis of temporal stability and gender invariance revealed that the items of the instrument are understood in a similar way by students despite differences in time and gender.

4.2. Discussion of Study 2

The purpose of study 2 was to assess through an SEM how the teacher's role influences the students' mind-wandering and this in turn influences anxiety. In this way, we intend to show evidence of validity of criterion for the MWQ-PE relating the scores of mind-wandering with respect to anxiety of students during PE classes. SEM revealed how support for autonomy negatively predicted mind-wandering; on the other hand, psychological control positively predicted it, and both factors having a significant influence on the state of mind-wandering. In turn, mind-wandering had a positive influence on anxiety, and this influence was significant.

4.3. General Discussion

The MWQ-PE is an effective tool with which to evaluate mind-wandering and thus better understand the distracting factors present in PE classes. The questionnaire showed that the factorial structure is adequate. Reliability analyses, through internal consistency and temporal stability analysis, revealed acceptable adjustment indices. As for the multigroup analysis, they showed that the structure of the questionnaire supports its use in future research where it is intended to compare the averages between students. Finally, from the SEM, evidence was found of how teachers have a significant influence on the state of mind-wandering and how the latter influences anxiety. In summary, this analysis showed that PE students with high levels of anxiety were predictors of mind-wandering.

These results are similar to previous studies in the field of clinical psychology [38–40], where it was suggested that increased mind-wandering could lead to increased negative moods, including increased anxiety [13,41]. Specifically, the increase in mind-wandering due to the presence of stress causes people to use their cognitive efforts to achieve mental equilibrium, despite the fact that this implies a diversion of attention from the task, which not only damages performance, but may also affect personal well-being [12,42]. In this way, PE students are no strangers to external circumstances that may involve a threat, appearing as a variety of negative thoughts linked to emotions such as shame [8], frustration, or helplessness [17], doubting their performance, body image, etc., increasing their cognitive anxiety and contributing to mind-wandering and therefore causing a lack of concentration and attention, which may lead to the development of unadaptive behaviors.

Some limitations of this study are that future researchers should analyze the structure of invariance with respect to other variables, such as age, type of center (e.g., concerted, private or public) or academic level. Also, as a prospective, it will allow cross-sectional and longitudinal studies where mind-wandering can be related to other variables and thus understand and investigate the adaptive and unadaptive behaviors of students during EF classes.

5. Conclusions

In conclusion, it is possible to state that the present study has shown evidence of the validity and reliability of the MWQ-PE in the Spanish context of PE classes. This questionnaire offers researchers a tool with which to measure inattention and mental vagrancy during EF classes.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Mind-wandering Questionnaire of Physical Education

Table A1. The instrument was validated in Spanish.

Mind-wandering
1. Tengo dificultad para mantener la atención ante los ejercicios sencillos o repetitivos (Spanish). - I have difficulty keeping my attention to simple or repetitive exercises.
2. Mientras hago los ejercicios tengo que repetirlos porque no he prestado atención (Spanish). - While doing the exercises I have to repeat them because I haven't paid attention.
3. Hago cosas sin prestar mucha atención (Spanish). - I do things without paying much attention.
4. Me encuentro prestando atención y pensando en otra cosa al mismo tiempo (Spanish). - I find myself paying attention and thinking about something else at the same time.
5. Me mente comienza a divagar durante las explicaciones del profesor o de los compañeros (Spanish). - My mind begins to wander during the explanations of the teacher or of the companions.

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