

## Article

# Gender Differences in Nutritional, Odontological and Psychological Patterns of Adolescent Students during COVID-19 Pandemic

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**Abstract:** This research aimed to explore gender differences in nutritional, odontological and psychological patterns of adolescent students during the COVID-19 pandemic. In order to achieve the study's aim, 127 adolescent students (17.61 ± 7.43 years) completed an online questionnaire which analysed variables regarding their psychological, nutritional, oral health, and physical activity profiles and habits during the COVID-19 crisis. Students showed a higher weekly alcohol consumption and higher levels of loneliness perception when alcohol consumption was lower. In addition, experimental avoidance and psychological inflexibility values were lower when the perception of having dry mouth or lack of saliva is higher. The results also show that males presented a more varied intake of food than females and a stronger adherence to physical activity routines. Female students presented a lower number of meals per day when beer and alcohol consumption was higher, and a higher tendency for fat- and sugar-rich foods such as fast food or bakery products than males. Regarding the oral health profile, females showed higher values in daily tooth brushing and no significant differences were found in dry mouth and gastritis variables. The results from the present study could be used by various educational institutions to implement multidisciplinary interventions to develop healthier habits.

**Keywords:** gender differences; COVID-19; students; loneliness; psychological inflexibility; experiential avoidance



**Citation:** Martín-Rodríguez, A.; Tornero-Aguilera, J.F.; López-Pérez, P.J.; Clemente-Suárez, V.J. Gender Differences in Nutritional, Odontological and Psychological Patterns of Adolescent Students during COVID-19 Pandemic. *Appl. Sci.* **2021**, *11*, 8499. <https://doi.org/10.3390/app11188499>

Academic Editors: Alessandro de Sire and Redha Taiar

Received: 29 July 2021

Accepted: 10 September 2021

Published: 13 September 2021

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## 1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic has affected the world population, with more than 110 million confirmed cases and more than 2.5 million deaths [1], generating a global health crisis. Related to this stressful life event, extended home confinement, brutal grief, interfamilial violence, overuse of the Internet and social media are factors that could influence the health of adolescents during this period [2]. In this complex situation, nutrition is a decisive component of health and growth more than ever. Nutrition is the study of how our body uses food to maintain and support its performance. Related to fostering stronger immune systems, having good nutrition patterns is essential to promote healthy outcomes and reduce the risk of many chronic diseases. In this line, unfortunately, the explanation of the increasing rates of nutritional illnesses in humans could be linked to dietary habits through different stages of life [2]. It is a well-known fact that adolescence is a period of rapid physiological changes; hence, adequate nutrition is crucial for achieving full growth potential [3]. This phase implies a time where a insufficient nutrition education and inadequate attitudes in their eating patterns could be associated with delayed growth, impaired cognitive maturation, behavioral health problems [4] and other chronic conditions associated with mental disorders [5]. In fact, during the period of confinement, nutritional

habits changed dramatically in parallel with the increase in anxiety and stress values among the population [6].

In reference to mental health, the COVID-19 health crisis has posed a complex scenario for adolescents, not only because of the youth's specific behavioural characteristics, but also because of its future repercussions. Findings suggest that if we compare students to other collectives, such as professors, students seem to present higher scores of stress and anxiety [7], with females presenting higher ratios and a growing and greater prevalence of depression among students [8]. In this context, if we analyse the role of nutrition in mental health, nutritional deficiencies could impact on it. There is increasing evidence of a link between a poor diet and the aggravation of mood disorders, including anxiety and depression [9]. Moreover, studies also connect perceptions of social isolation, or loneliness with malnutrition [10]. According to this, at the present time, it is known that the COVID lockdown has affected the dietary habits and nutritional patterns of different countries [11], and it has had psychological effects on university students with many risk factors for promoting anxiety, with depressive symptoms, stress, and anxiety being the most commonly identified psychological effects [12]. Therefore, there are several important aspects that may be considered when dealing with such a relevant situation.

Attending to the dimensions of oral health, appropriate oral health management and disease prevention of children is very important for children's health. In a COVID-19 context, the management of children's oral health presents specific problems related to the infectious spread of the disease. In general, the prevention of oral health in children is based on the periodicity of check-ups and on oral hygiene education through adequate information; however, the increased stress level linked to home confinement could impact on children's oral patterns [13]. The need to spend the whole day in a home setting can stimulate more lively play modes in children, with an increased risk of traumatic events affecting the dental elements [14]. Moreover, increased frequency of eating is considered to be the primary dietary factor associated with the caries process [15]. During the COVID-19 pandemic specifically, in Spain, it has been reported that the diet maintained during the lockdown had a larger energy intake and lower nutritional quality than the pre-COVID-19 eating patterns [16]. In general, correct oral health must always be combined with a healthy lifestyle. Therefore, physical activity, sleeping for an adequate number of hours, and proper nutrition and hydration throughout the day are strongly recommended. It is undeniable that evidence shows every benefit of physical activity and nutrition in youth. Findings suggest that optimizing physical activity and nutrition confers positive outcomes for youth mental health and wellness, even on the developmental trajectory vulnerable to psychiatric disorders [17].

In this multifactorial context, the future policies implemented by governments will depend on vaccine effectiveness, vaccination strategies and herd immunity [18]. Although wearing a mask and social distancing may be a mandatory, social isolation measures will be only adopted by citizens who have contact with confirmed COVID-19 cases and these positive subjects. These less restrictive policies may evoke an improvement in physical activity and nutrition habits which would produce positive outcomes for youth mental health and wellness.

The objective of the present research was to analyze gender differences in nutritional, odontological and psychological patterns of high school students during the COVID-19 pandemic. The initial hypothesis was that there would be gender differences in these nutritional, odontological and psychological patterns.

## 2. Materials and Methods

### 2.1. Participants

We studied 127 high school students, 0.023% of the current enrolled adolescent students from two different schools in Jaen and Madrid. Among them, 47.7% were men ( $18.88 \pm 4.18$  years) and the rest of them were women (52.7%,  $17.61 \pm 7.43$  years). All of them filled out an informed consent form, and when they were under 18 years old, written

parental consent was obtained in accordance with the Helsinki Declaration's guidelines. This study was approved by the university ethical committee (CIPI/18/074), the direction of the educational centre and the parents' association.

## 2.2. Procedures

The week before data collection, a visit was made by the researchers to introduce themselves to the adolescents and to show the devices used for the data collection to familiarize them with every procedure. Students aged between 17 and 25 years were interviewed via online questionnaire in the first trimester of their academic year. To reach the aim of the present research, a cross sectional study was developed. The following parameters were analysed.

*UCLA Loneliness Scale*: This scale has 20 items, and it measures the perceived social isolation. It is answered on a Likert scale where 1 = "never" and 4 = "always".

*Acceptance and Action questionnaire-II*: This questionnaire has 7 items, and it measures experiential avoidance and psychological inflexibility.

*Physical activity* with a questionnaire in which adolescents were asked about the time per week (h) they spend performing strength-based physical activities, aerobic-based physical activities, daily physical activity, and collective-based physical activities. Each answer was a score ranging from 1 to 5, where 1 = "less than 30 min", 2 = "between 30 and 60 min", 3 = "between 1 and 2 h", 4 = "between 2 and 3 h", 5 = "more than 3 h".

*Body composition* by weight, height, and body mass index (BMI) calculated using the classic formula:  $\text{weight}(\text{kg})/\text{height}(\text{m})^2$ .

*Hours of sleep* per day were measured on a self-perception scale, indicating the number of hours the student sleep per day.

*Nutritional habits* were analysed using an adapted previously used questionnaire. The first 2 questions were related to eating habits. The rest of the questions were related to the consumption frequency of different food groups, including fish, vegetables, legumes, meat, fast food or soft drinks. Each answer was a score ranging from 1 to 6, where 1 = "I do not consume", 2 = "less than three per week", 3 = "three or more per week", 4 = "seven or more per week", 5 = "ten or more per week", 6 = "more than thirteen".

*For oral health*, a previously used questionnaire consisting of 4 items related to oral health was used. For the first question, "How many times a day do you brush your teeth?", the answers ranged from "none" to "more than four per day."

## 2.3. Statistical Analysis

Statistical analyses were analyzed using the Statistical Package for the Social Sciences (SPSS) version 24.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics (mean and standard deviation) were calculated for each variable. Kolmogorov–Smirnov tests were performed to analyze the normality and homogeneity of each variable. To analyze gender differences in the study variables, an independent T test was conducted. A bivariate correlational analysis was conducted with the Pearson test. The level of significance for all the comparisons was set at  $p \leq 0.05$ .

## 3. Results

According to the oral health profile, females showed higher values in daily tooth brushing and no significant differences were found in dry mouth and gastritis variables. Females consumed higher levels of fast food and bakery products than males, who present higher consumption of vegetables, rice, pasta, legumes, fish, milk, cheese, beer and alcohol than women. Differences were found in physical activity habits; the collected data show that females are more sedentary than males (Table 1).

**Table 1.** Differences between males and females in the study variables.

Variable	Gender	Mean $\pm$ SD	t	Sig. (Bilateral)	% Confidence	
					Lower	Upper
Age (year)	Male	18.88 $\pm$ 4.18	1.169	0.245	−0.88060	342.339
	Female	17.61 $\pm$ 7.43				
Meals (number/week)	Male	4.10 $\pm$ 0.93	−0.994	0.322	−0.45973	0.15227
	Female	4.25 $\pm$ 0.80				
Sleep (hours/day)	Male	7.75 $\pm$ 0.89	1.108	0.270	−0.13846	0.49095
	Female	7.58 $\pm$ 0.89				
Mobile (hours/day)	Male	4.08 $\pm$ 3.12	−1.663	0.099	−189.346	0.16460
	Female	4.94 $\pm$ 2.73				
Height (cm)	Male	172.76 $\pm$ 17.21	4.828	0.000	643.268	1.536.931
	Female	161.86 $\pm$ 6.36				
Weight (kg)	Male	68.53 $\pm$ 12.07	5.795	0.000	803.684	1.637.311
	Female	56.32 $\pm$ 11.63				
Body mass index (Kg/m <sup>2</sup> )	Male	25.78 $\pm$ 27.27	1.268	0.207	−240.151	1.096.588
	Female	21.50 $\pm$ 4.34				
Smoke	Male	1.35 $\pm$ 0.86	1.760	0.081	−0.02691	0.45825
	Female	1.13 $\pm$ 0.48				
Teeth (times/day)	Male	3.26 $\pm$ 0.97	−5.240	0.000	−117.480	−0.53067
	Female	4.11 $\pm$ 0.86				
Gastritis	Male	2.73 $\pm$ 0.44	−1.884	0.062	−0.27136	0.00669
	Female	2.86 $\pm$ 0.34				
Mouth	Male	2.71 $\pm$ 0.45	0.382	0.703	−0.14590	0.21560
	Female	2.68 $\pm$ 0.55				
Juices	Male	2.18 $\pm$ 0.87	−1.087	0.279	−0.61137	0.17803
	Female	2.40 $\pm$ 1.29				
Alcohol	Male	1.23 $\pm$ 0.42	0.429	0.668	−0.12035	0.18702
	Female	1.20 $\pm$ 0.44				
Beer	Male	1.45 $\pm$ 0.87	2.467	0.015	0.05851	0.53379
	Female	1.15 $\pm$ 0.40				
Wine	Male	1.06 $\pm$ 0.25	−0.805	0.423	−0.14197	0.05992
	Female	1.10 $\pm$ 0.31				
Soft drinks	Male	2.06 $\pm$ 1.08	−0.507	0.613	−0.50277	0.29764
	Female	2.16 $\pm$ 1.16				
Energy drinks	Male	1.45 $\pm$ 0.87	1.765	0.080	−0.02856	0.49779
	Female	1.21 $\pm$ 0.59				
Milk	Male	3.66 $\pm$ 1.46	1.900	0.060	−0.02025	0.98435
	Female	3.18 $\pm$ 1.36				
Fermented milk	Male	2.91 $\pm$ 1.29	0.987	0.326	−0.21012	0.62807
	Female	2.70 $\pm$ 1.07				
Cakes	Male	2.15 $\pm$ 0.93	−2.164	0.032	−0.77333	−0.03436
	Female	2.55 $\pm$ 1.13				
Cheese	Male	2.66 $\pm$ 1.09	1.618	0.108	−0.07329	0.72971
	Female	2.33 $\pm$ 1.16				

Table 1. Cont.

Variable	Gender	Mean $\pm$ SD	t	Sig. (Bilateral)	% Confidence	
					Lower	Upper
Eggs	Male	2.66 $\pm$ 0.95	1.959	0.052	−0.00311	0.59798
	Female	2.36 $\pm$ 0.74				
Meat	Male	3.10 $\pm$ 1.17	1.572	0.118	−0.08164	0.71241
	Female	2.78 $\pm$ 1.06				
Fish	Male	2.45 $\pm$ 0.90	0.686	0.494	−0.21023	0.43330
	Female	2.33 $\pm$ 0.90				
Cold meat	Male	2.75 $\pm$ 1.22	0.272	0.786	−0.36270	0.47809
	Female	2.69 $\pm$ 1.14				
Legumes	Male	2.55 $\pm$ 0.83	1.386	0.168	−0.09059	0.51367
	Female	2.33 $\pm$ 0.87				
Rice	Male	2.48 $\pm$ 0.87	1.196	0.234	−0.11517	0.46645
	Female	2.30 $\pm$ 0.76				
Pasta	Male	2.58 $\pm$ 0.90	1.471	0.144	−0.07939	0.53837
	Female	2.35 $\pm$ 0.83				
Fruit	Male	3.25 $\pm$ 1.36	1.697	0.092	−0.06456	0.84148
	Female	2.86 $\pm$ 1.19				
Raw vegetable	Male	2.58 $\pm$ 1.16	1.166	0.246	−0.17069	0.66043
	Female	2.33 $\pm$ 1.17				
Cooked vegetable	Male	2.80 $\pm$ 1.35	2.277	0.025	0.06427	0.92034
	Female	2.30 $\pm$ 1.05				
Bread	Male	3.13 $\pm$ 1.38	−0.666	0.506	−0.63117	0.31322
	Female	3.29 $\pm$ 1.28				
Whole grain	Male	2.66 $\pm$ 1.45	1.568	0.119	−0.09424	0.81219
	Female	2.30 $\pm$ 1.08				
Fast food	Male	1.75 $\pm$ 0.60	−2.816	0.006	−0.66148	−0.11545
	Female	2.13 $\pm$ 0.89				
Acceptance and Action questionnaire-II	Male	17.41 $\pm$ 8.37	−1.023	0.308	−517.306	164.819
	Female	19.17 $\pm$ 10.73				
UCLA Loneliness Scale	Male	3.78 $\pm$ 1.45	0.025	0.980	−0.55722	0.57165
	Female	3.77 $\pm$ 1.73				
Daily physical activity (hours/week)	Male	3.41 $\pm$ 1.13	1.287	0.200	−0.15784	0.74502
	Female	3.12 $\pm$ 1.38				
Aerobic based physical activities (hours/week)	Male	1.96 $\pm$ 1.17	2.723	0.007	0.13789	0.87236
	Female	1.46 $\pm$ 0.88				
Collective based physical activities (hours/week)	Male	2.15 $\pm$ 1.32	4.483	0.000	0.47037	121.425
	Female	1.30 $\pm$ 0.70				
Performing strength based physical activities (hours/week)	Male	2.03 $\pm$ 1.30	4.930	0.000	0.50798	118.946
	Female	1.18 $\pm$ 0.46				

BMI: body mass index (Kg/m<sup>2</sup>).

The correlation analysis showed a significant negative correlation between loneliness (UCLA) and alcohol consumption ( $r: -0.203, p: 0.024$ ), experimental avoidance and psychological inflexibility and dry mouth or lack of saliva values ( $r: -0.349, p: 0.000$ ). Regarding dietary habits, a negative significance correlation was found between the number of meals per day and BMI ( $r: -0.240, p: 0.006$ ). Moreover, lower values of fruit consumption were

found when values of alcohol consumption are higher ( $r: -0.251, p: 0.005$ ). Additionally, we found a significant positive correlation between alcohol consumption and bakery product consumption ( $r: 0.234, p: 0.009$ ), fast food intake ( $r: 0.360, p: 0.000$ ), mobile usage ( $r: 0.215, p: 0.016$ ) and smoking habits ( $r: 0.227, p: 0.011$ ). Furthermore, correlation analysis showed a significant positive correlation between weight and alcohol consumption ( $r: 0.298, p: 0.021$ ) and a significant negative correlation between the number of meals and alcohol ( $r: -0.507, p: 0.000$ ) in females. In males, the data showed a significant positive correlation between mobile usage and alcohol consumption ( $r: 0.362, p: 0.003$ ), soft drink consumption ( $r: 0.472, p: 0.000$ ) and rice consumption and weight ( $r: 0.258, p: 0.0038$ ); however, female students present higher mobile usage when beer consumption values were higher ( $r: 0.316, p: 0.014$ ) and also reported higher values of BMI when alcohol consumption was higher ( $r: 0.0257, p: 0.0047$ ).

#### 4. Discussion

The aim of the present research was to analyze gender differences in the nutritional, odontological and psychological patterns of high school students during the COVID-19 pandemic. The initial hypothesis was partially confirmed, since gender differences were found in nutritional and odontological patterns, but no differences were found in the psychological patterns of adolescent students during COVID-19 pandemic.

We found that Spanish students presented a more intense feeling of loneliness when alcohol consumption was lower. In contrast, Belgian students and workers declared that loneliness is one of the motives that drove them to consume more alcohol during the lockdown [19]. Adolescence is a period of growth where the importance of developing social competence and the capacity to engage effectively in social relationship is essential [20]. Previous authors suggested that loneliness or a lack of a sense of belonging and social support in this phase could lead to the development of mental health problems such as social and behavioural diseases [21–23]. This may explain adolescents' vulnerability to substance abuse, more specifically, alcohol consumption. In this line, some facilitators of alcohol use among adolescents were highlighted, for example, lifestyle, high levels of stress and anxiety, low self-esteem, depressive symptoms, susceptibility to peer pressure and problems associated with school [24]. Drinking in social environments is a common habit among youth people, where alcohol is perceived to enhance social interactions and, in consequence, reduce their feeling of loneliness.

The highest alcohol consumption levels in adolescents were in line with the highest levels of smoking and mobile usage. This corresponds with previous research which presented a correlation between alcohol, smoking, and mobile use [25]. In line with this fact, authors pointed out that smoking could be recognized as a social habit that improve motivational processes, social acceptance and belonging, and so it may be viewed as a result of chronic isolation, loneliness and the loss of social contact [26]. Previous studies have suggested that adolescents use these habits as their only way to escape or a type of self-medication to reduce discomfort associated with feelings of loneliness, hopelessness, anxiety, and rejection [27]. Additionally, we found that males presented higher beer consumption than females. It has been reported that males have more factors that place them at greater risk for disruptive drinking than girls, with the main reasons being their low response to alcohol, later maturation in brain structures and executive function, greater estimates of perceived peer alcohol use, and socialization into traditional gender roles [28,29]. Thus, the feeling of loneliness and the desire for social connection could drive excluded and lonely students to engage in unhealthy habits such as alcohol consumption, smoking, or excessive mobile phone usage. Additional research is needed to explore specific strategies that may be effective in supporting lonely adolescents. It is also necessary to strengthen educational work and advocacy of the importance of a healthy lifestyle among young students in order to reduce their vulnerability to alcohol and smoking addiction and create interventions targeting cognitive weaknesses in substance use initiation.

Concerning the experimental avoidance and psychological inflexibility levels, our study showed a negative correlation between them and the dry mouth or lack of saliva odontological variables. Studies show how one of the modifications that occurred in the stress response is the decrease in saliva production, which could produce the feeling of dry mouth and a lack of saliva [30,31]. People with high experimental avoidance and psychological inflexibility may possess limited resources to cope with contextual demands, which can lead to a higher stress response, distress and feelings of vulnerability [32]. This distress could have a negative effect on students' academic functioning, their adaptation to their environment, and overall quality of life [33,34]. It is recommended that educational institutions should implement psychological flexibility techniques such as acceptance and commitment therapy to reduce students' stress symptomatology and, in turn, improve their overall wellbeing [35].

According to students' nutritional patterns, males have a more diversified diet than females. In addition, a negative correlation was found in females between the number of meals per day and beer and alcohol consumption, as well as a higher intake of fat- and sugar-rich food, fast food and bakery products than male students. Moreover, female adolescents presented higher BMI values when alcohol consumption was higher too. In contrast, previous research found that female university students had healthier habits related to nutrition, while men showed a high level of overweight and obesity [36]. This should be taken into account because inflammation throughout the body and brain could be caused by processed foods, which may contribute to mood disorders, including anxiety and depression [37]. The literature also suggests that a strong relationship exists between the ingestion of foods rich in fat and/or sugar and the modulation of emotional states; in other words, palatable food intake could relieve negative emotions caused by the current pandemic context [38]. Following other studies, women may be mentally and emotionally more vulnerable to the effects of COVID-19 pandemic than men, and so this situation could evoke a change in their habits, enhancing their vulnerability to alcohol and, in consequence, provoking an adverse effect on their health [39].

There is a consensus about the features of an unhealthy diet, characterised by higher intakes of processed foods, sugar-sweetened beverages, trans and saturated fats, added salt and sugar, and lower intakes of fresh fruits and vegetables. However, there is less agreement on the exact elements of a healthy diet [40]. In this line, male adolescents showed higher values for vegetables, rice, pasta, legumes, fish, meat, milk, and cheese intake than women. Thus, females showed a poorer quality diet than males. In line with a healthy lifestyle, women participate in less physical activity than men. Regarding both nutrition patterns and physical activity habits, it has been demonstrated that there is a strong connection between healthy nutrition and adequate physical activity [41]. Hence, these findings may support the idea that men presented a healthier lifestyle than women. This also seems to be associated with better mental health; previous researchers demonstrated that there are associations between unhealthy dietary patterns and worse mental health in childhood or adolescence [42], being mediated by the gut-brain axis and highlighting the importance of adequate nutrition and physical activity for biological and mental health [43].

Regarding oral health, women had higher values for daily teeth brushing and no significant differences were found in dry mouth and gastritis variables. This higher frequency in daily tooth brushing corresponds with previous studies and may be linked to the higher values of neuroticism and conscientiousness shown by females [44,45].

The health habit variables evaluated are self-reported so there is still a chance of an information bias. The validity of answers is a general problem of online surveys. This research also presents a limitation because of the lack of biological measurement due to COVID-19 and the impossibility of measuring stress hormones (cortisol, adrenaline, alpha amylase. . .). In addition, the severe lockdown measures, such as social distancing, have hindered physical practice procedures.

As a future research line, we propose analysing the influence of cultural differences in the levels of perceived danger from the COVID-19 pandemic [46], analysing family compo-

sition, which may have an influence on the feeling of loneliness, and analysing economic status differences, which may have a strong influence on health habits. Additionally, this study could be extended to other degrees, as well as to other educational levels such as primary and secondary school.

## 5. Conclusions

There were gender differences in the nutritional and odontological patterns of adolescent students evaluated during the COVID-19 pandemic and no significant differences in psychological patterns. Males showed a higher frequency of consumption of vegetables, rice, pasta, legumes, fish, meat, fruit, milk, and cheese and practiced more physical activity than females, who showed a higher frequency of consumption of sweet beverages, fast food and bakery products. Additionally, females showed higher values in daily tooth brushing and no significant differences were found in dry mouth and gastritis variables. In this dynamic situation, further research into adolescent gender differences, attitudes toward nutrition, physical activity habits and psychological patterns in times of uncertainty is needed to provide recommendations regarding appropriate lifestyle habits in post-COVID-19 times. Knowing that psychological variables have a meaningful influence on physiological response results, future research could improve students' strategies to deal with their social contexts and environments that are highly fluctuating. Educational institutions should try to implement multidisciplinary strategies to face stress situations without losing healthy habits. These findings reveal the importance of considering multiple social behaviours when examining factors relating to adolescent mental health.

**Author Contributions:** Conceptualization, V.J.C.-S.; methodology and formal analysis, V.J.C.-S. and P.J.L.-P.; investigation, V.J.C.-S. and J.F.T.-A.; data curation, V.J.C.-S.; writing—Original draft preparation A.M.-R., J.F.T.-A., P.J.L.-P. and V.J.C.-S.; writing—Review and editing, A.M.-R., J.F.T.-A., P.J.L.-P. and V.J.C.-S.; visualization, V.J.C.-S.; supervision and funding acquisition, V.J.C.-S. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the European University Ethics Committee (CIPI/18/074).

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** All data are presented in the manuscript.

**Acknowledgments:** We want to acknowledge the collaboration of students, families, and teachers.

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

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