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Sustainability and healthy habits in School: eating and physical activity

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Abstract

Obesity in childhood has become a major global public health concern. Its considerable increase in the last decades took the World Health Organization (WHO) to regard this fact as one of the greatest public health challenges of the 21st century. Diagnosing, intervening and, above all, preventing obesity in the early stages of life becomes urgent and justified by the innumerable health complications found in adults. It´s expect and fundamental that schools provide practices in order to promote good health habits, given opportunity to the students keeping them for their future life according a lifelong education.

This research was carried with 15 students, aged 6 to 7 years old. Their body mass index (BMI) was calculated, we held a questionnaire about their eating habits related to the Mediterranean Diet (MD) and the significance of healthy eating and physical activity (PA) practicing was discussed. We measured their PA using accelerometers. Data were analyzed with specific software and some of them were discussed bases on qualitative analysis.

The results of this study showed improvements in the PA of the participants after intervention, it`s also demonstrate that is possible promote health behaviours in articulation with other areas of knowledge.

Keywords: Childhood obesity; healthy habits; physical activity; sustainability; lifelong education

1. Introduction

1.1. Problem in study

Obesity has become one of the biggest public health problems of the 21st century. In the last 20 years this prevalence in children and adolescents has increased dramatically worldwide, and this trend should continue (Viitasalo *et al*., 2016). According to the WHO (2018), childhood obesity is strongly related to a greater predisposition to develop certain health problems, among them: cardiovascular diseases, type 2 diabetes, orthopedic problems, mental disorders, low school performance and low self-esteem.

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More and more obese children are emerging, so that should be a strong reason why something needs to be done to prevent this increase and to promote interventions that sensitize for good practices of healthy habits (Hoor, Plasqui, Schols & Kok, 2017). It is well known that the preservation of good health depends to a large extent on the adoption of healthy lifestyles, which allow us to prevent not all diseases, but a large measure of them. Healthful life routines are constructed from an early age, as the probability of their effectiveness increases exponentially. It is a fact that in a society in constant transformation, where new technologies today play a very important role in the lives of all young people and children, their advent leads to an effective decrease in their PA, free of the conviviality, of the sharing.

The regular practices of PA are being annihilated by the new technologies, by the supposed lack of time, and consequently the sedentary is establishing itself. Nowadays, most of the children have less free time to PA and/or to play unstructured which is considered to be related with the enhance of non-communicable health problems (Odiaga & Doucette, 2017).

We believe that the possibility of interposition in health conducts through school education is crucial for the promotion and construction of good eating habits associated with a regular practice of PA.

1.2. Relevance of the study

Given that, it can be stated that early adopters of healthy eating and of a more active lifestyle are more likely to support their whole life. Childhood and adolescence, they may be the most favorable periods of life for a change and acquisition of knowledge and, above all, health promoting behaviours. On the other hand, obese children are more likely to become obese adults and consequently develop and experience a greater risk of health issues (Bussiek, Poli & Bevan, 2018).

The WHO (2018) recalls that over 60% of children who are overweight before puberty will be overweight in early adulthood. That's why Nekitsing, Hetherington and Blundell-Birtill (2018) mentioned to childhood as a very important phase for the development of healthy eating habits, justifying that these habits, when adopted at an early stage of life, tend to continue a future pattern.

The cause of obesity is a complex process, which is influenced by both genetic and environmental factors (Rey-López, Rodríguez, Biosca & Moreno, 2008). However, the same authors stated that the exponential increase in the prevalence of obesity suggests that, in fact, environmental factors, such as poor diet and insufficient PA, are more significant than genetic factors. PA is known to have many benefits for children´s physical and mental health, in opposite sedentary behaviours were known for having a several negative health impacts (Carol, Lewis, Katzmarzyk, Dumuid, Cassidy & Olds,

2016). Furthermore, behaviours that established bad alimentary choices have a straight relationship with a higher association risk of developing obesity (Louisa, Mehta, Scott, Tonkin & Coveney, 2018). So, it´s substantial to disseminate the importance and necessity of a new concept of global health education in order to achieve sustainable and long-term changes in behaviours, enhancing the importance the necessity of sustainability in articulation with health nutrition, in order to prevent excessive food consumption that compromise "the ecological systems that are crucial to sustainability" (Lawrence, Burlingame, Caraher, Holdsworth, Neff & Timotijevic, 2015, p. 2287). We already known that is essential to using the school to encourage the practice of healthy habits, directed in the way to move toward a food system that keeps us—and the planet—healthy is for all citizens to become more food literate (Pamela, 2016, p. 53).

In fact, because children spend much of their time in school, there is a good reason to believe that the school environment can be a critical influence on their health behaviour patterns. WHO (2018) states that schools are a privileged setting in the reduction and prevention of obesity and overweight, since they allow an intensive and constant contact with children during their formative years. So, given that children spend much of their time in school, it´s their belief that healthy behavioural patterns can be significantly influenced by school environment (Pearson, Haycraft, Atkin & Johnston, 2017).

1.3. Aim of the Study

In research, a problem arises from a need detected in a given context, which leads to the need to act in this direction (Barbot, 2017). The purpose of the investigation should be to meet this same need evidenced in the problem. From the above, it´s known the importance of school to promote moments of reflection with the students, in a process that allows them to become aware of the importance of PA, encouraging the exercise of it, rethinking their daily practices with them.

The participants of this study did not benefit from this type of initiatives. On the other hand, in this field of education, there is a tendency to justify the lack of time to fulfill the programmatic content inherent to other areas of knowledge, thus giving rise to a new problem, to which we will look to answer too in this study, by trying to demonstrate if it´s possible to develop expression and physical-motor education (EPME) classes in articulation with other areas of knowledge. From the above we formulate two research questions (RQ): RQ1 - Will it be possible to develop EEFM classes in order to consolidate and explore contents and knowledge of other curricular areas evidenced in the curriculum? RQ2 - Will it be possible, through the use of accelerometers and subsequent reflection with the students of the initial data monitored by them and with a critically analyze about the results obtained, in order to promote an improvement in their PA levels? Barbot, emphasizes that in research, a question should be a question that expresses something relevant that we don't know, but we wish to know (Barbot, 2017).

Concomitantly, Tuckman (2012) writes that an investigation is a systematic attempt to find answers to research questions. These two questions will guide the way forward throughout this study, in order to respond them.

2. Method

2.1. Research Model

This investigation assumes a study case dimension, in which we got involved and it was developed specifically for the students who were part of it, constituting the participants of this research. We followed them for a few months and got completely integrated in the context, in the case under study. This research strategy assumes a logic that guides the successive stages of data collection, analysis and interpretation of qualitative methods, with the particularity that the purpose of the research itself is the intensive study of one or a few cases (Meirinhos & Osório, 2010). So, alongside this study case, the concept of qualitative research is associated, but it´s emphasized that qualitative research does not advocate leaving aside data of a quantitative nature, in fact, although they have different objectives, they can arise in an articulated way; the quantitative research seeks the logic of discovery and qualitative research the logic of knowledge construction (Meirinhos & Osório, 2010). Throughout the present study, data of both natures, qualitative and quantitative, will be considered.

During this study case video and audio recordings were made with the aim to guarantee the evidence of participants statements (Tuckman, 2012), which helped to reflect on various moments of intervention, as well in the elaboration of multimodal narratives (MN). These have proved to be an asset in the development of investigative and educational practices, stemming from the need felt to create an instrument that could collect data not only about the class but from within the classroom that would help preserve its completeness and complexity (Lopes, Viegas & Pinto, 2018). So, the audio recordings help in the constructions of NM that allow to analyze in a more detailed and objective way all the events that occurred in educational context. In addition, the direct observation is considered one of the best techniques of data collection (Mascarenhas, Maia & Martínez, 2017).

2.2. Participants

The participants studying in a public school located in the metropolitan area of Porto, 20 children, aged 6-7 years, belonging to the same classroom were invited to participate,

but only 15 (53% girls and 47% boys) met the inclusion criteria. It is a very heterogeneous class, since the students reveal to have different tastes and rhythms of learning.

2.3. Data Collection Instruments

Monitoring data were obtained through anthropometric measurements, weight (kg) and height (m) measurements, from which the BMI was calculated; of the scores of dietary behaviors, with application of the KIDMED and the level of PA, through the application of accelerometers. Data collection took place between November 2017 and April 2018 and a written consent was obtained from parents and school supervisors.

2.3.1. Anthropometric measures

Body mass and height were measured by standard anthropometric methods. Body mass was measured to the nearest 0.10 kg, with participants lightly dressed (underwear and t-shirt only) using a portable digital scale. Height was measured to the nearest millimeter in bare or stocking feet with children standing upright against a Holtain portable stadiometer. The measurements were repeated twice, and the average was recorded. BMI was calculated and classified according to WHO into three groups, normal weight, overweight and obesity. Waist to ratio (WHR) was calculated as the ratio of waist (cm) and height (cm).

2.3.2. Physical Activity (PA)

Daily PA was measured using the ActiGraph GT3 accelerometer. This accelerometer provides output in activity counts, which gives information about the intensity of PA (Janz, 1994). Alternatively, accelerometer output can be interpreted using specific cut-points, which identify time in different intensities of PA. Data reduction, cleaning and analyses of accelerometer data were performed using an Actilife program. Data were analysed using specific cut-points, which have been validated for children: ≥2280 cpm for moderate to vigorous physical activity (MVPA) already had been used in several studies. PA was monitored for seven consecutive days (Monday to Sunday). A minimum of 8h of data per day and a minimum of 3week days were required for analysis.

2.3.3. Dietary behaviours

In the evaluation of food standards, the KIDMED was used. The main objectives of this instrument were to characterize eating habits. This consists of a questionnaire with sixteen questions, which are given a score of +1 or -1, depending on its agreement with the Mediterranean Food (Bach, Berry, Lairon, Reguant,Trichopoulou & Dernini, 2011). The sum of the values obtained varies in a scale of 0 and 12 and allows classifying the adhesion to the MD in three levels: level 1 - high adhesion (> 8); level 2 - intermediate adhesion (4-7) and level 3 - low adhesion (≤ 3). The questionnaire was applied on the

individual interview form, taking into account the age group of participants, it is understood that it was not possible to be filled directly by them.

2.3.4. Intervention

We developed six sessions classes of EPME that motivated the students to practice PA, including more playful features and establishing connections between different areas of knowledge, like Maths, Nature Sciences and Portuguese. The data collected with the accelerometers before the six interventions were analysed and discussed with the students. The data register after the interventions, were analysed statistically in comparison with the initial data, to observe if there was an improvement in the practice of PA of the participants between this two moments. Furthermore, at an early stage of this study case we held a questionnaire about their eating habits related to the MD by using the KIDMED. The importance of healthy eating was discussed, it´s important to refer that "future guidelines for sustainable diets to be realistic they will need to take into account modern lifestyles, cultural and social expectations in the current food environment" (Macdiarmid, 2014, p. 368).

3. Results

In order to discuss the results obtained we create three dimensions, the first one analyzes the curricular articulation present in the six intervention sessions, in the second one we identify a set of epistemic practices in which the students became involved, and in the third the discussion of the data was present with the aim to evaluating if there was an improvement in the fight against sedentary lifestyle in order to increase the levels of daily PA.

3.1. First dimension: curricular articulation

After the six work sessions that characterized a large part of this research study, to analyze if the objectives were reached and to answer the first question of investigation formulated here, we create three categories that correspond to the three curricular areas explored in the classes. They are presented in the table 1 with the program contents present in the curriculum official, that was possible explore in these sessions. We also identify some student evidences about their involvement in activities.

Table 1. Areas of knowledge presents in the sessions of EPME

	Areas of knowledge	Students evidences
MATHS	• Cardinal of a set • Identification of numbers on the number line • Comparison of numbers (major and minor) • Addition of natural numbers • Subtraction of natural numbers • Ten • Geometric figures • Areas • Venn Diagrams	*-Missing a student in this group, we have an element unless.* *-I was wrong, I have count again to not pass any number.* *-You must sit 4 is less than 5.* *-8 less 0 cannot be 0 ... always gives the first number.* *- It's easier to put a bar to represent 10 and then put what is missing using the squares.* *-The square must have sides all equal.* *-You cannot count like this, now we must count the number of tiny triangles.* *-We must form 3 sets.*
SCIENCE	• Human Body • Butterfly life cycle • Laterality • Location relative to a reference point • Floating • Coating and locomotion of animals • Presence of water in food	*-The orange is better, because have more water…* *-Remember the vegetables, can be large and float.* *-This is not your right side.* *-After the cocoon comes the butterfly.* *-The snake has scales, but they are different from the scales of the fishes.*
PORTUGUESE	• Word formation • Number of syllables • Rhyming words • Interpreting stories	In these activities was evident a constant sharing of ideas and feelings, stimulating children's imagination and the fantasy world characteristic of storytelling's.

About the six sessions of physical-motor stimulus classes that motivated the students to practice PA, we verified that they promote intellectual challenges that provide learning experiences and knowledge consolidation. In fact, the involvement of the students was always evident, and in a very motivated way they solved challenges and consolidated knowledge in such a playful way that their joy was evident in all sessions. In addition, was clear that it is possible to develop classes of EPME in articulation with other areas of knowledge presents in curriculum. The creation of these kinds of sessions contextualized with other curricular areas provided significant moments of learning for the children, stimulating at same the practise of PA.

In terms physico-motor, most of the participants were able to carry out the activities autonomously, sometimes the time management in some of them was adapted taking into account their development. There were some where the students liked it so much that we eventually extended their exploration and, whenever it was appropriate, made some variations or adaptations in the implementation of these. It is also emphasized that, considering that many of the proposed activities were dynamized in teams, it was constantly evident the mutual aid between the various elements of each group. It should

be noted that this type of organization provided moments in which students learned to work in groups, respecting and supporting their colleagues.

The final feeling is great satisfaction, because throughout the class the students were involved in the proposed activities, consolidating and improving knowledge in a fun, orderly and participative way. In fact, childhood is a period of growth, formation and development and as such has in lududism its predominant and primordial activity (Sousa, 2003). According to the same author, the child through the playful activity, increase their pysical and cognitive development. Neto (2009) refers the importance of this kind activitis in first years of life, by the inumeral advantages in childs development, specificaly "in the structuring of the brain and its neural mechanisms; in the evolution of language and literacy; in the capacity of physical and motor adaptation; in cognitive structuring and problem solving; in socialization processes; and, finally, in the construction of self-image, creative capacity and emotional control" (p. 20). All activities proposed during the sessions took into account the promotion of PA practice, in conjunction with playful moments in favor of content consolidation and curricular knowledge with the participants

3.2. Second dimension: epistemic practices

Throughout the implementation of this study, it was visible by direct observation and NM analysis, identify a set of epistemic practices in which students became involved. To do so, and in order to reflect some of these moments, it´s considered pertinent to present at this stage, the statistical data obtained in this study, which are organized in the following tables.

3.2.1. Statistics and data analysis

Means and standard deviation (SD) were calculated to describe children's characteristics by sex. It was analysed the KIDMED results and the comparison of PA before and after intervention. Statistical analysis was performed using the SPSS 24.0 software, including Test Mann-Whitney and Test Wilcoxon. The level of significance was set at alpha level of 0.05.

Table 2. Areas of knowledge presents in the sessions of EPME

	Total (n=15)		**Boys (n=7)**		**Girls (n=8)**	
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Weight	26,40	5,11	26,14*	4,56	26,6250*	5,85
Height	1,21	0,04	1,22*	,045	1,2000*	,039
BMI	18,03	2,95	17,60*	2,55	18,405*	3,39
Waist perimeter	66,20	7,20	63,71*	6,82	68,375*	7,23
KIDMED	5,60	2,64	7,00	1,73	4,38	2,77

***p>0.05**

In table 2, we verified that although girls have higher BMI and waist perimeter than boys, these differences are not statistically significant (p>0.05). About eating habits, the participants demonstrated results that are in accordance with good eating practices, situate in level 2 - intermediate adhesion to the MD. Although, we denoted that most of the children responded to please the teacher, despite the questionnaire was applied as individual interview form. It was also observed that the students who presented the highest levels of adherence to the MD were the ones that had the highest BMI and waist perimeter, which again indicates that the results obtained in this questionnaire raise doubts about their reliability. In relation to this topic, the importance of healthy eating was reflected with students at various points throughout this study. For example, in one class we explored the amount of sugar present in the snacks that the students usually eat during school breaks, to discuss healthier alternatives. In this class, some of the student's epistemic practices were identified, presented in the table 3.

Table 3. Epistemic practices

Epistemic practices of students (Lopes, Viegas & Pinto, 2018, p. 166)	**Students evidences**
Establish relationships	*-I must drink more water.* *-Juices have lots of sugar!*
Critically appraise	*-Then it does not do well.* *-It's not healthy.*
To argue	Several students understood that oats would be a healthy food, comprising the richness of the nutritional value of it, as opposed to other cereals.

Learning should be considered as a construct that involves the experiences and ideas of children and should take into account situations in the context of children. In a first year of schooling, it is important to create moments of reflection in harmony with environments that embark learning more directed to practical questions of their practices day. The purpose of this session was to alert and inform students about the amount of sugar in various snacks consumed by them during the break. In fact, we noticed that although it was policy of the school to have only one day in week when it was possible to bring a less healthy and less nutritious snack, it´s true that many of them ended up bringing it regularly, without realizing the weak nutritional value of some snacks. In this context, in this session we bring snacks that we observed that the participants usually consumed in the breaks, and we tried to explore the quantities of sugar present in each them, suggesting some healthier options, don´t forgetting that previous knowledge and ideas of the child, or the student, always determine how he interprets the teacher's suggestions and how he tries to solve a given task (Pereira, 2002). In an after session, we discussed with students discussed the importance of eating healthy, questioning what

they would think would be healthy eating, whether the important eat healthy. In general, they considered healthy eating as eating lots of vegetables, fruits, water and soup, saying that *eating healthy is eating healthy things*. We asked them if they could eat sweets in a healthy diet, some of them immediately say *no*, others answer that *they didn´t know*, and about 3 students said *yes*, one of them refer *we can eat once for many days*, another one said *we can eat one day a week*, *but then we have to go wash our teeth*. Most of the participants ended up associating the excessive consumption of sugar and salt with two specific negative effects, namely: *toothache* and *stomach pain*. After a large group discussion about the need for a varied diet and reflecting critically and soundly on the dietary options, students understood that eating a healthy and varied diet does not imply that cannot eat sweets. But that they must do it with conscious and moderation, considering on a varied diet, mobilizing prior knowledge in the presentation of their ideas, highlighting another epistemic practice, namely "presents a mobilizing idea" (Lopes, Viegas & Pinto, 2018, p. 166).

Table 4. Physical activity before and after intervention

	Total (n=15)		Boys (n=7)		Girls (n=8)	
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**	**Mean**	**Std. Deviation**
Baseline	57,86	18,36	69,32*	19,77	47,83*	9,66
After intervention	62,20	19,85	76,19**	13,40	49,95**	16,32
Δ After - Baseline	4,34	16,14	6,88	21,25	2,11	11,03

***p>0.05**

The baseline data monitored by the accelerometers, presents in table 4, were discussed in large group, it was emphasized that, when they were presented, the participants were immediately motivated and interested. Initially we questioned if they thought they were practicing enough PA, some students answered that they *didn't know*, others answered that they *thought they did*, and the most part said that they *practiced a lot of exercise*, yet some of these student's data didn´t showed or support the affirmations of themselves. It´s underlined that in this first phase the average of the participants did not reach the daily recommendations of 60 minutes daily of MVPA. Most of the girls considered that they practiced a lot of daily PA, but in fact the data don't show that. We questioned them if they thought it was important to practice PA and why. All of them answer *yes*, replied with various justifications, here are some examples: *because i do not like being fat, I want to be skinny; to stay strong; i do gymnastics because it works well; so we can eat more sweets; it's important to be healthy.* After reflecting about some benefits of PA, we explained that, at the very least, all of them should complete 60 minutes of MVPA daily, we distributed a sheet with their individual data and asked them to check if in the 3 days

monitored by the accelerometers they reached 60 minutes MVPA, after we discuss these results.

Some participants, mainly females, found that they did not reach any of the days, and were surprised with these conclusions observation. Once again, some epistemic practices of the students were visible in these moments of reflection, namely: "to argue; to interpret; and evaluate critically" (Lopes, Viegas & Pinto, 2018, p. 166). Argued that they did not do as much PA as they initially thought, so they would try to practice more activitie and physical exercise, in oposite to sedentary behaviors routines, demonstrating an understanding of the observed data and the need to improve, interpreting and evaluating them critically and reflectively. It´s understood that the accelerometers functioned as a technological device that allowed the obtaining of these data, sustaining these reflections, functioning as a pillar in this research study, leaving here the recognition of the same in the attainment of the proposed objectives. The richness and diversity of this data, and the fact that they could look at their own behaviors in the form of numbers, charts and grids, promoted their engagement and rich learning moments.

3.3. Third dimension: Discussion of statistical data monitored by accelerometers

After analyzing the data measured by the accelerometers we verified that there was an improvement in practice of PA between the first and second monitoring. One of the main aspects of this comparison is that before the intervention the mean results indicate that the participants did not meet the recommendations of PAGs, after intervention the data reveal different results, evidencing an increase of 4,34 minutes in PA, which led to a mean that meet the PAGs recommendations. However, we verified that one of the elements of the participants, that was diagnosting with borderline characteristics with autism spectrum presents one decrease in his PA after the intervention. If we don´t take account this student the mean of increase in minutes of PA will pass from 4,34 to 7,20 minutes.

Therefore, the treatment of the data obtained shows that although there are differences between the sexes before and after intervention, these are not significant when we analyze the expected average value. However, it should be noted that in both sexes the daily minutes of PA increased between the first and second monitoring, although this increase was more significant in boys. In fact, the boys meet the PAGs recommendations in the two moments, but between them the PA increase 6,88 minutes. In the girls despite PA increase too, it was only 2,11 minutes, and the mean of them still don´t meet the PAGs recommendations after intervention.

4. Discussion and Conclusions

According to the findings of this study, it was seen that the possibility of intervention in health through school education is crucial for the promotion a regular practice of PA, and in the construction of health eating habits, that includes too, a sustainability challenge in the eating practices. When given that early models of healthy eating and a more active lifestyle, children are more likely to maintain this pattern during their whole life as childhood and adolescence may be the most favourable periods of life for an acquisition of knowledge and, above all, of health promoting behaviour, contributing to sustainability. In this study we verified that the participants of this study were able to understand the importance healthy lifestyle, mostly to have self-awareness about their eating habits and the importance of daily physical activity.

Through the collected data and subsequent analysis, it was possible to answer both RQ. Regarding QI1 - "Will it be possible to develop EPME classes in order to consolidate and explore contents and knowledge of other curricular areas evidenced in the curriculum?" this study allowed to demonstrate that is in fact possible to dynamize this kind of classes that enable a promotion of articulation knowledge with other curricular areas. This type of class is an added value both in terms of the students physical and motor development, encouraging the taste for practicing PA, as it allows the consolidation of knowledge and contents. It seems that Rigal (2006) agrees that PA plays a fundamental role not only in the development of children's sensorimotor coordination, but also in the development of their cognitive functions, contributing to their full development. Corroborating this idea, Papalia (2001) point out that all aspects of the child's development, namely: *physical, cognitive, emotional and social,* are in fact in close relation, so it is justified to promote this dynamic of classes where all these dimensions are worked in harmony. Concerning QI2 - "Will it be possible, through the use of accelerometers and subsequent reflection with the students of the initial data monitored by them, to critically analyze with them the results obtained in order to promote an improvement in levels of physical activity?" we verified that the levels of PA increased between the moments before and after intervention, showing that the initial average of these did not meet the PGAs recommendations and that after the intervention they were fulfilled.

In the end, from the above, we concluded that the school and the teacher, due to the close reach that they establish with his students, giving priority to an almost daily direct contact with them, entails an increased responsibility in the holistic formation of all of them, in the development of their personality and behaviours. That´s why the school presents itself as a place conducive to the development and promotion of healthy habits, in the integration of these in the interests and motivations of the students, moving towards an inclusion of these practices in their daily lives. So, is important to dynamize entrepreneurship in the context of education, in schools, formalizing activities that

promote the PA, allied to articulation of knowledges that stimulate epistemic practices invigorated by the students. It is recognized the importance of promoting innovative, creative practices that translate into competences that promote curricular articulation in close relation with PA, so it´s essential for schools and teachers to stimulate initiatives in this field.

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