

Adolescent girls' and boys' situational interest for a learning task in physical education

ELISE ALLARD-LATOURL¹, JULIETTE RANNOU², GILLES KERMARREC³

^{1,2,3}.STAPS, Université de Bretagne Occidentale, FRANCE

Published online: June 30, 2022

(Accepted for publication June 15, 2022)

DOI:10.7752/jpes.2022.06170

Abstract:

This study investigated the role of sex in the difference of situational interest sources for Physical Education students in different physical activities. First, as most studies have shown that total situational interest scores are higher for young boys than young girls, we hypothesised that this difference for situational interest continues during adolescence to the detriment of girls. Second, we hypothesised that effect of physical activity programs combined with sex could explain differences in total interest between students. Third, we hypothesised that the sex variable has an impact on five situational interest sources and could explain in part the total differences in situational interest. The sample consisted of 422 French primary and secondary school students, aged 12-16 years. The students completed the French 19-item situational interest scale after practicing a technical learning task in Physical Education contexts. A two-factor ANOVA was carried out to examine the interaction effects of students' sex and different physical activities on situational interest and the five situational interest sources. The results showed that boys' situational interest scores are higher than those of girls. Furthermore, instant enjoyment and exploration intention are the sources that have the most impact on situational interest for boys, and attention demand is the highest source for girls. There is also a very significant combined effect between physical activities, sex and situational interest for Physical Education. This study encourages teachers to consider the difference of interest between girls and boys and offers supplementary evidence of the teacher's role in promoting students' situational interest and engagement.

Key Words: - situational interest, girls, boys, adolescents, physical education

Introduction

Interest theory has been used to analyse motivation in education sciences area (Rotgans & Schmidt, 2017) and over the past few years is a theoretical framework used in a Physical Education (PE) setting. Although research on motivation and sex (Lentillon-Kaestner & Roue, 2019), or gender (Chalabaev et al., 2013), has provided informative findings, the focus usually is on comparing personal factors such as perceived competence of boys and girls (Chalabaev & Sarrazin, 2009), their perceived value for Physical Education (Fontayne et al., 2001), or perceived learning (Lee et al., 2012). Nevertheless, Renninger and Hidi (2016) recently suggested that students get more involved in a learning task because of their interest than because of their personality or perceived ability. Research has rarely addressed whether sex-related motivation issues in PE settings could be explained by environmental factors (Chen and Darst 2002). In this study, we adopted the theoretical framework of interest-based motivation in order to examine situational interest (SI) differences between boys and girls in middle and high school PE, as well as its environmental sources. According to Renninger (2000), interest is defined as a psychological state characterised by an intensive effort correlated with a high level of attention. This state is also accompanied by pleasurable feelings as well as a sense of achievement and highlights prolonged engagement in an activity. Interest is conceptualised as an intrinsic motivational variable but also content-dependent (Renninger & Hidi, 2016). In education research, interest has been conceptualised as both individual and situational (Hidi, 2000).

Individual interest (II) is defined as an individual psychological disposition associated with a preference for a type of actions/activities. It is relatively stable psychological disposition and develops over time. On the contrary, SI fluctuates because it is determined by the relation between an individual and the environment, and is therefore context-specific. It refers to the appealing effects of the environment's characteristics that trigger responses from an individual. In a PE setting, SI is the appeal from a sport or a physical activity situation, leading to a total SI, and resulting from different sources (Chen and Darst 2002). The five sources are novelty, challenge, attention demand, exploration, and instant enjoyment and remain relevant in many studies in American, Asian and European PE settings (e.g. Roue and Pasco 2018).

Specifically, (a) novelty refers to information deficiency between known and unknown information, (b) challenge is defined as the level of difficulty relative to one's ability, (c) attention demand is the concentrated cognition and the mental energy required in learning an activity, (d) exploration is conceptualised as the learning aspects that drive the learner to explore and discover, and (e) instant enjoyment refers to the characteristics that lead the learner to an instant positive feeling of being satisfied (Zhu et al., 2009). Therefore, even if recent debates on SI factorial structure has emerged (Garn, 2017), SI seems to be an appropriate tool to measure girls' and boys' motivation in PE classes (Roue et al., 2016).

SI is identified as being a relevant motivator for students in PE, and authors have demonstrated that SI has positive effects on the development of students' knowledge in PE (Chen et al. 2006), their energy expenditure level (Zhu et al., 2009), the pursuit of extracurricular activities (Chen 2014), and the learning strategies used by students in PE (Roue et al., 2019). In

addition, it has been demonstrated that SI is dependent on learning task design (Chen and Darst 2002; Roure and Pasco 2018) and could vary according to the type of feedback delivered to students (Roure et al., 2017).

Although a large literature suggests that sex and gender have a great impact on personal motivation (Chalabaev et al., 2013), only few studies investigated the role of sex in the difference of interest for students in different academic subject area (e.g. Cosnefroy 2007). In this study, in PE, direct effect of sex on II was established and perceived competence was the strongest predictor of interest. It has been demonstrated that the reaction of students to physical activities could be explained due to gender stereotypes (Fontayne et al., 2001; Plaza, 2016). Gender describes those characteristics of women and men that are largely socially created, while sex encompasses those that are biologically determined (World Health Organisation, 2019). In other words, stereotypes are assumed to affect how individuals perceive themselves, and subsequently how they behave (Chalabaev et al., 2013). They behave to correspond to the suitable way of their sex by observing gender roles. Cultural traditions are found to shape gender stereotypes of physical activity (Williams & Bedward, 2001), and boys and girls are sensitive to social expectations in sports. While boys demonstrate a need for physical contact in sports in accordance with masculine identity (Gard & Meyenn, 2000), girls' perceptions of expected engagement are more ambiguous (Flintoff & Scraton, 2005). Thus, gender stereotypes in physical activities such as soccer or dance could be directly reflected in II for sport and PE, with potential consequences on distinctive SI in learning task in those activities (Shen et al., 2003).

The theoretical framework of SI focuses on understanding the link between a person, the environment, and the pedagogical content, and not on understanding the personal internal process of motivation. In previous studies, researchers compare boys' and girls' SI for PE, and discussed their results by explaining the sex effects by the role of gender (Lentillon-Kaestner & Roure, 2019). They made the hypothesis that sex is a predicator of gender effect (Chen and Darst 2002). Authors concluded that sex differences should not be consider as an isolated factor when investigating students' SI in PE. Authors explained girls' and boys' II for PE by the fact that physical activities perception are a mediating variable under the direct influence of gender. Furthermore, links between II and SI are supposed. Gender stereotypes surrounding physical activities may influence II with potential influences on SI, although SI is theoretically more or less independent of II. On the one hand, II and SI are two different theoretical concepts (Renninger, 2000), but on the other hand, these concepts are linked by the theoretical framework of the dynamic of interest (Hidi & Renninger, 2006). This correlation could be explained by Alexander's theory (Alexander et al., 1995), which showed that boys, by a social phenomenon do more sports than girls during childhood, so boys make more physical progress. The skills obtained by boys play a large role in increasing perceived competency, and therefore II for physical activities. Thus, because II and SI are connected (Renninger, 2000), SI for PE also increases. SI differences between girls and boys could be moderate by gender, skill and also the differences between the SI sources that impact students.

Consequently, research on motivation in PE should consider the hypothesis that SI differences can be a mirror of boys' and girls' motivation. But, previous studies in PE comparing the total SI between boys and girls do not agree that total SI scores are always higher for boys than girls (Chen, Darst, and Pangrazi 2001; Chen and Darst 2002; Shen et al. 2003; Shen, Chen, and Guan 2007; Kermarrec, Roure, and Pasco 2014; Lentillon-Kaestner and Roure 2019). Indeed, Shen et al. (2003) reported a study in which sixth- to eighth-grade boys and girls (N=57) reported no difference in SI scores in a 4-week dance unit. Lentillon-Kaestner and Roure (2019) added that in Switzerland (N = 177), non-significant main effect of student sex was found. Chen, Shen and Guan (2007) showed in their study (N= 177) that girls had higher SI than boys during a softball unit. However, Chen, Darst and Pangrazi (2001) and Chen and Darst (2002), in their studies of a seventh and eighth grade (N = 191) basketball class, showed that sex difference, favourable for boys, might be explained by their higher physical level in learning motor skills. In addition, a French study (France, N= 110) conducted with 11-12-year-old-students, found that boys demonstrated more SI than girls in PE, no matter the activity (Kermarrec et al., 2014).

Some limits of these studies should be considered and may explain the differences on results. Inconsistent findings may be due to small sample size in most studies (N = 57 to 191) and to differences in students' age. While difference has been found in children's total SI (10-12 years old) (Kermarrec et al., 2014), there is no difference between girls' and boys' SI in 14 years old adolescent students (Lentillon-Kaestner & Roure, 2019). In addition, most of the studies have been focused on total SI, and only two of them investigated sex effect on SI sources without being in accordance in the findings (Kermarrec et al., 2014; Lentillon-Kaestner & Roure, 2019). The French study maintained that attention demand and instant enjoyment are the sources that have the most impact on students in mixed sex research (Kermarrec et al., 2014). The results showed that novelty is also an important source of SI especially for young girls. The study of Lentillon-Kaestner and Roure (2019) showed that boys and girls did not score differently on the SI sources when comparing single sex and coeducational context in PE. Differences in findings may also appear because of data collection in a several physical activities (e.g. only Basketball or only dance or different activities), within PE teaching setting, with potential consequences on girls' and boys' perceptions. It seems that sex differences in SI could reflect gender stereotypes that students hold for different activities. Indeed, male students tend to have higher expectancy beliefs for 'masculine' physical activities (e.g. bodybuilding), whereas female students feel more competent at 'feminine' physical activities (e.g. gymnastics) (Lentillon, 2009). Other activities are recognised as neutral activities, and are associated with both feminine and masculine gender (e.g. badminton, volleyball, outdoor activities) (Plaza, 2016).

Considering the inconsistent findings on differences in SI scores in PE between boys and girls, the very limited investigation of the effect of the programmed physical activities, and the lack of data for boys' and girls' differences in sources of SI, the purpose of this study is to identify the effect of sex in total sources of SI in PE classes for students, and the effect of a physical activity programs. Because difference in boys' and girls' SI are reported, and even if perceived competencies seems to be the main predictor of this difference, it is important to understand how to counterbalance this personal factor with a learning task design factor. Thus, the multidimensional model of SI justifies to investigate sources as independent variables which may have different impacts on total SI for boys and girls. Furthermore, because perceived competences and interest are influenced by social expectations in sports, it is also important in PE context to investigate the effect of the programmed physical activities on boys' and girls' SI.

Three hypotheses were proposed for this study. First, as most studies showed that total SI scores are higher for young boys than young girls, we hypothesised that this difference would remain for SI adolescent students to the detriment of girls. Second, we hypothesised that effect of the type of physical activities combined with sex could explain differences on

total SI between students. Third, we hypothesised that variable ‘sex’ would have an impact on the SI sources and could explain part of the total SI differences.

Material & methods

Participants

Participants were 422 middle and high school students from the west part of France. Of these participants, 163 were boys and 259 were girls, aged between 10 and 21 years old ($M=14.63$, $SD=2.96$). These students came from 9 ($N=194$) classes of middle school and 8 classes of high school ($N=228$). The ethical boards of these schools gave the consent to conduct the study. Indeed, the students’ parents were informed about the scope of the study and their authorisation was required in order to their children to participate, in accordance with the Helsinki Convention. Sex was identified by status official statements made by parents in school records. Students were reminded that their participation was voluntary, that their individual responses would be confidential and that they could withdraw from the study at any time.

PE teachers participating in this study had various teaching experience ranging from one to several years. A large panel of physical activities were taught (i.e. badminton, gymnastics, bodybuilding, outdoor activities, collective activities). No specific criteria have been followed to select sports. Orienteering and kayak were gathered in outdoor activities, and collective activities gather basketball, baseball and volleyball. 124 students participated to collective sport lessons. 64 students were taught badminton. 24 students participate to gymnastics lessons. 62 students were taught outdoor activities. 148 students participated to bodybuilding lessons. Table 1 resume the panel of students by their age, sex and activities there are involved in.

Table 1. Population figures, sex and physical activities

Age	Number of students									
	Badminton		Gymnastics		Bodybuilding		Outdoor activities		Collective activities	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
10-12	5	14	10	14			23	20	15	15
13-14	20	20					5	14	3	11
15-16	1	4			11	3			52	28
17-18					83	16				
19-21					31	4				

Measures

Situational Interest

The French 15-item SI scale (Roure et al., 2016) was used to measure boys and girls SI during the learning tasks. This scale identifies five sources: novelty (e.g. ‘what we did today was new to me’), instant enjoyment (e.g. ‘What we did was enjoyable for me’), exploration intention (e.g. ‘I wanted to analyse and have a better handle on what we were learning today’), attention demand (e.g. ‘what we were learning demanded my high attention’), and challenge (e.g. ‘what we were learning was hard for me to do’). This scale includes three items for each source. These items are arranged randomly and rated on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Internal consistency (Cronbach’s alpha) was established which was greater than .76 (between .70 and .90) for all SI sources among middle and high school (Roure et al., 2016).

Total situational interest - Furthermore, the French 4-item scale (Roure et al., 2016) was established to evaluate students’ total SI in the learning tasks. The scale is unidimensional and consists of four items (e.g. ‘what we were learning was interesting for me to do’). Like the previous scale, the items were placed randomly and rated on a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree.

Procedure

In each physical activity, the learning task performed by students lasted twenty minutes. Teachers were requested to taught, as usual, a technical learning task, in order to preserve meaningful ecological validity of the findings. Following this, PE teachers distributed the SI scales (Roure et al, 2016), and students completed it individually and anonymously, sit away from each other. To minimize students’ tendency to give socially desirable responses, the students were encouraged to answer honestly and assured that their responses would remain anonymous and confidential. PE teachers collected the SI scales one by one while students were seated, without looking at the responses. Researchers recovered the SI scales at the end of the lesson.

Data collection and analysis

Students’ responses were aggregated respectively to total SI and to the five SI sources (i.e. instant enjoyment, exploration intention, attention demand, challenge, and novelty). The SI scale results were analysed according to the factors ‘sex’ and ‘physical activities program’. The statistical analyses were performed as follows: Preliminary analyses were conducted on the study variables to examine the normality of the subscale by the Kolmogorov-Smirnov Test. These preliminary analyses were important to bring together the data of the 422 participants in this study, independently of their sex. Then, descriptive statistics were performed, again according to the sex factor. Finally, a first variance analysis (ANOVA) was performed to compare the SI sources according to the sex, and a second variance analysis (MANOVA) was performed to compare total SI according to the sex and physical activities program factors, considered as independent. Version 0.14.1.0 of JASP (University of Amsterdam) was used for all statistical analyses. The JASP analyses are implemented with R and are considered as accurate for robust statistical analysis (Love et al., 2019).

Results

Preliminary analysis

The normality test (Kolmogorov-Smirnov) revealed that the data were normally distributed. This result certified the possibility of performing inferential statistical analyses. The descriptive statistics (Table 2) showed differences of interest between girls and boys according to the SI sources and therefore in the learning situation.

Main analysis

The ANOVA results (Table 2) revealed a significant main effect of the sex on SI ($F(1, 420) = 5.684, p < .01$). More precisely, the scores for total SI, and two SI sources (instant enjoyment and exploration intention) were higher for male students. This result indicated a higher total SI in PE for boys than girls, ($F(1, 421) = 17.89, p < .01$). The SI source ‘instant enjoyment’ revealed the greatest difference between the sex ($F(1, 421) = 28.18, p < .01$). The SI source ‘exploration intention’ is also a source of differentiation between girls and boys ($F(1, 421) = 4.25, p < .05$). The results of the others SI sources, ‘challenge’, ‘attention demand’ and ‘novelty’ did not significantly differ between boys and girls. For boys, the highest source score is for ‘instant enjoyment’ ($M=3.65, SD=1.04$), for girls it is ‘attention demand’ ($M=3.18, SD=0.87$).

Table 2. Descriptive statistics of SI sources for boys and girls in PE, and ANOVA results of SI sources with sex factor

	Boys (N=163)		Girls (N=259)		ANOVA		
	M	SD	M	SD	F	p	η^2
Total situational interest	3.50	1.01	3.11	.83	17.89	< .001*	.01
Challenge	2.53	1.05	2.51	.83	.06	.81	.02
Attention demand	3.22	1.04	3.18	.87	.22	.64	.26
Instant enjoyment	3.65	1.01	3.14	0.92	28.18	< .001*	.06
Novelty	2.53	1.36	2.37	1.06	1.64	.20	.10
Exploration intention	2.99	1.04	2.80	.81	4.25	.04*	.05

Notes. *M*: mean, *SD*: standard deviation

Table 3 summarises the total SI scores for boys and girls, depending on the programmed physical activity. The MANOVA results between the effects of sex and physical activities on total SI scores is represented in Table 4. We found that there is a sex by physical activity interaction effect ($F(2,368) = 4.000; p < .01$) in the total SI measures for PE (Table 4). Post-hoc analyses showed only one significant difference between total SI scores for boys and for girls for outdoor activities ($t = 4.458, p < .01$).

Table 3. Descriptive statistics of total SI score for boys and girls by physical activities in PE

	Boys (N=163)		Girls (N=259)	
	M	SD	M	SD
Badminton	3.595	0.935	3.446	0.968
Gymnastics	4.321	0.668	3.910	0.897
Bodybuilding	3.213	0.506	3.138	0.514
Outdoor activities	3.809	0.961	2.825	0.956
Collective activities	3.152	1.147	2.970	1.050

Table 4. MANOVA results of total SI scores with sex and physical activity

Cases	Sum of Squares	df	Mean Square	F	p	η^2
APSA	26.645	4	6.661	8.908	< .001**	0.076
Sexe	8.413	1	8.413	11.251	< .001**	0.024
APSA * Sexe	9.003	4	2.251	3.010	0.018*	0.026
Residual	308.077	412	0.748			

Note. F: test value, η^2 : effect size.

Discussion

The purpose of this study was to investigate the role of sex in the difference of SI and SI sources between girls and boys for PE in different physical activities. We compared SI of girls’ and boys’ during PE lessons. Participants were French adolescent students (from 10 to 21 years old). Five types of physical activities were taught (badminton, gymnastics, bodybuilding, outdoor activities, collective activities). The French 19-item SI scale (Roure et al., 2016) was used to measure boys and girls SI during the learning tasks.

As most studies showed that total SI scores are higher for young boys than young girls, and even that sex should not be a factor when investigating student’s SI, we hypothesised that this difference remains for SI adolescent students to the detriment of girls. Second, we hypothesised that the sex variable has an impact on the SI sources and could explain in part the total SI differences, as a mediator variable. Third, we hypothesised that the effect of different physical activity programs combined with sex could explain differences on total SI between students.

The results showed that boys’ SI scores are actually higher than for girls. The data reported that, regardless of the physical activity, boys feel more SI than girls. Furthermore, instant enjoyment and exploration intention are the sources that have the most impact on SI for boys, and attention demand is the higher source for girls. These findings are discussed according to the three hypotheses mentioned above.

Difference of total SI for learning task in PE between boys and girls

First, our results revealed a significant main effect of sex on SI. The analysis indicated a higher total SI score for boys than girls in PE. These results with adolescent participants are in accordance with a previous study (Lentillon-Kaestner & Roure, 2019) that indicated a difference between young girls’ and young boys’ SI, to the detriment of young girls. Moreover, our study design has a high statistical significance because of a large sample of adolescent boys and girls compared with studies with smaller sample sizes (e.g. Shen et al. 2003, N=57).

Total SI score difference between sex may be interpreted by the students’ skill level and their perceived competencies. Chen and Darst (2002) hypothesised that total SI score difference is correlated to level of skills in the learning task. If girls have lower total SI scores, our results suggest that girls could have a lower skill level than boys in the programmed physical activities (Lentillon-Kaestner & Roure, 2019). This correlation could be explained by Alexander’s

theory (Alexander et al., 1995), a social phenomenon revealing that boys do more sports than girls during childhood, so boys make more physical progress. Skills play a large role in the increasing of perceived competency, and so of II for physical activities, and consequently in the increase of SI in most of academic subject areas (Renninger, 2000). Hypothetically, skill level, more developed by boys in physical activities, explains the difference of SI between girls and boys for PE.

Furthermore, our study was conducted in French PE context. Differences in skill level between boys and girls are currently observed in PE achievement assessment in France: girls tend to obtain one point less than boys on their PE mean at the end of high school in national diploma (Lentillon-Kaestner & Cogérino, 2005). A recent study showed that SI in PE has great effect on learning strategies (Roure et al., 2016). Learning strategies are also considered as key components for achievement in school contexts (Pintrich, 2002). While French PE program aimed at sustaining girls' involvement (Official French curriculum, 2015), our results showed an effect of sex on SI for PE, at the detriment of girls and confirmed the difficulty for teachers of moving from pedagogical programs recommendations to real practices (Ottogalli-Mazzacavallo & Szerdahelyi, 2019). Even skills and perceived competency are great predictor of SI, there is a need to support teachers in learning task design. Sources that trigger SI could be a guide to design task and motivate more girls for PE.

Finally, that data stress that actual French PE program is more suitable for boys than girls because the lower skills and lower performances influences the decrease of SI, and vice versa. Our findings led to two potential explanations: the indirect effect of physical activities program on SI and the direct effect of SI sources on SI differences.

Sex and SI sources

We hypothesised that sex variable has an impact on the SI sources and could explain in part the total SI differences. Indeed, more precisely, two SI sources' scores (instant enjoyment and exploration intention) were significantly higher for adolescent boys than adolescent girls. These two SI sources are known to have the most impact on total SI score (Chen and Darst 2002; Lentillon-Kaestner and Roure 2019). Because instant enjoyment and exploration intention are the most discriminant sources between sex, this result explains why sex has an effect on total SI scores.

Furthermore, instant enjoyment is the most important source for learning tasks in PE, according to a study investigating the sources of SI for PE in many countries (Roure et al., 2019). Roure and Pasco (2018) suggested that instant enjoyment has a direct impact on total SI. They also added that there are indirect effects of challenge on SI, mediated by instant enjoyment. This link is explicated because students feel instant enjoyment only if they also feel competent in the learning task (Cairney et al., 2012). Indeed, skill achievement influences the level of enjoyment for a situation. If the learning task is too simple or too difficult, students don't feel pleasure to dedicate their time to practice (Smith & St Pierre, 2009). Thus, this difference of SI in PE for girls and boys may reinforce teacher attention in task challenge and encourage them to design "feel good" task within fun, pleasure, with expected direct impact on instant enjoyment, and hypothetically on girls' total SI.

Previous studies demonstrated that attention demand is an indirect source of SI for students in France (e.g. Roure and Pasco 2018), whatever the sex. Our results showed that attention demand is the highest source's score of SI in PE for girls. This result should encourage teacher to design learning task with cognition demand and with high mental energy required in addition to physical demand.

Effect of the type of activity in PE on boys' and girls' total SI difference

The results of our MANOVA study between sex, physical activities and SI agree with literacy trends. Our results show a combine effect of physical activity programs combined with sex on total SI between students. The type of activity in PE influence boys' and girls' SI difference. This difference can be interpreted by referring to previous studies highlighting the relationship between social expectations and physical activities perceptions (Plaza, 2016). It has been shown in academic subjects area that II begins to distinguish, between girls and boys, from early childhood (Renninger, 2000). This differentiation is due to the socialization, as school, where children learn to associate a behaviour with a gender. Stereotypes are learnt and applied by children, until adolescence. Usually, boys have a higher II than girls for sciences and for sports. According to the theory of interest (Hidi, 2000), difference between girls and boys SI may be explained by the way that stable II could influence SI. Personal values and expectations of an activity may influence the scores of the interest in situ (Hidi & Renninger, 2006). The fact that boys are more attracted by programmed physical activities in PE, could explain that girls have lower SI scores in PE.

Taken together, types of physical activities may influence SI, because some of them matches with gender values (Plaza, 2016). Nevertheless, post-hoc analyses showed only one significant difference on total SI score between girls and boys for outdoor activities to the detriment of girls. We are surprised by this result because outdoor activities are considered as neutral activities. Thus, girls seem less motivated for neutral activities. This result makes us think like Plaza (2016) who suggests to avoid neutral physical activities in order not to reduce girls' motivation with neutral physical activities. This author gives more importance to the alternation of both masculine and feminine activities in order to motivate students to participate in PE. Furthermore, the reason that explain the SI difference between girls and boys and between classes, might be the teaching itself, independently to the type of physical activity. Teachers might be playful or smiling, say encouragement and trigger SI in the classroom while other teachers could be barriers to SI in PE, if feedbacks or behaviours are negative. The reason, valid for all students, young or older, may play a more important part in the difference of SI between girls and boys. Lentillon Kaestner and Roure (2007) encourage teachers to pay attention on their feedbacks and speeches in order not to have stereotypical behaviours. In our study, the non-gender way to teach PE might not be respected or aimed, and so girls or boys suffered from a stereotyped teaching and didn't reach to a higher SI.

Effect of the type of activity in PE on boys' and girls' total SI difference

By comparing the effects of sex on SI sources' scores, boys and girls don't engage themselves for the same reasons in an activity. Teachers should know that girls react less to instant enjoyment and exploration intention than boys in PE, regardless of the current task demand. They should also know that girls' interest is more stimulated by the attention demand. This study offers supplementary evidence of teacher's role in promoting students' SI and engagement. Beyond accounting for students' personal factors (e.g. skill and perceived competency), PE teachers can significantly impact students' SI in PE through environmental disposition and task contents (e.g. SI sources). As demonstrated in previous studies (e.g. Lentillon-Kaestner and Patelli 2016), students' motivation and engagement seem to be more dependent of teacher choices and contextual variables than students' characteristics, and it is necessary that researchers and teachers search for and propose

pedagogical solutions: a) to sustain attention and cognitive demand; b) to pay attention in task difficulty to adapt it to each student, and allow girls and boy to feel fun and have enjoyable experiences in PE; c) to adopt non-gendered approach of physical activities; d) to introduce more feminine physical activities in French PE context in order to support girls' II and SI.

Limitations and future research

When interpreting and generalising our study, certain limitations of our findings should be considered. First, physical activity perception and gender effect on SI has not been directly assessed. Future investigations could study the effect of gender and not only sex on SI, and explain the process that causes this difference of total SI scores. It would be interesting to use the Personal Attribute Questionnaire (PAQ) (Spence et al., 1975), to better understand the gender of the students and execute the SI analyses to confirm the link between sex and gender we interpreted in our discussion. Theoretically, gender could influence II for physical activities and affects SI in PE. Future studies could also measure gender perception of the programmed PA to better understand the relationships between physical activity, II and SI.

Second, considering the model of interest development conceptualised by Hidi and Renninger (2006), the results of this study could be extended by evaluating the role of II in various physical activities in total SI score and in the SI sources' scores. It might then be possible to understand the potential dynamic of SI in masculine, feminine or neutral activities.

Third, a longitudinal study may inform us of II dynamic and the impacts that it has on the engagement of girls and boys. It would be interesting to verify the physical activity rate of students, when they feel a high SI, and to connect SI evolution to physical activity rate. Further, it would be important to measure this physical activity rate, when their II is higher, in order to confirm the transformation of SI into II, by improving physical engagement. The challenge for teachers and interventional researchers is to contribute to the physical engagement of both boys and girls in PE, but moreover outside the school, when the mandatory aspect disappears.

Conclusions

By comparing the effects of sex on SI sources' scores, boys and girls don't engage themselves for the same reasons in an activity. Teachers should know that girls react less to instant enjoyment and exploration intention than boys in PE, regardless of the current task demand. They should also know that girls' interest is more stimulated by the attention demand. This study offers supplementary evidence of teacher's role in promoting students' SI and engagement. Beyond accounting for students' personal factors (e.g. skill and perceived competency), PE teachers can significantly impact students' SI in PE through environmental disposition and task contents (e.g. SI sources). As demonstrated in previous studies (e.g. Lentillon-Kaestner and Patelli 2016), students' motivation and engagement seem to be more dependent of teacher choices and contextual variables than students' characteristics, and it is necessary that researchers and teachers search for and propose pedagogical solutions: a) to sustain attention and cognitive demand; b) to pay attention in task difficulty to adapt it to each student, and allow girls and boy to feel fun and have enjoyable experiences in PE; c) to adopt non-gendered approach of physical activities; d) to introduce more feminine physical activities in French PE context in order to support girls' II and SI.

Conflicts of interest - The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References:

- Alexander, P. A., Jetton, T. L., & Kulikowich, J. M. (1995). Interrelationship of knowledge, interest, and recall : Assessing a model of domain learning. *Journal of Educational Psychology*, 87(4), 559-575. <https://doi.org/10.1037/0022-0663.87.4.559>
- Cairney, J., Kwan, M. Y., Velduizen, S., Hay, J., Bray, S. R., & Faught, B. E. (2012). Gender, perceived competence and the enjoyment of physical education in children : A longitudinal examination. *International Journal of Behavioral Nutrition and Physical Activity*, 9(1), 26. <https://doi.org/10.1186/1479-5868-9-26>
- Chalabaev, A., & Sarrazin, P. (2009). Relation entre les stéréotypes sexuels associés aux pratiques sportives et la motivation autodéterminée des élèves en éducation physique et sportive. *Science et Motricité : revue scientifique de l'ACAPS / ACAPS*, 66, 61-70.
- Chalabaev, A., Sarrazin, P., Fontayne, P., Boiché, J., & Clément-Guillotin, C. (2013). The influence of sex stereotypes and gender roles on participation and performance in sport and exercise : Review and future directions. *Psychology of Sport and Exercise*, 14(2), 136-144. <https://doi.org/10.1016/j.psychsport.2012.10.005>
- Chen, A., & Darst, P. W. (2002). Individual and Situational Interest : The Role of Gender and Skill. *Contemporary Educational Psychology*, 27(2), 250-269. <https://doi.org/10.1006/ceps.2001.1093>
- Chen, A., Darst, P. W., & Pangrazi, R. P. (2001). An examination of situational interest and its sources. *British Journal of Educational Psychology*, 71(3), 383-400. <https://doi.org/10.1348/000709901158578>
- Chen, A., Ennis, C. D., Martin, R. J., & Sun, H. (2006). Situational interest : A curriculum component enhancing motivation to learn. *New developments in learning research*, 235-261.
- Chen, W. (2014). Psychological needs satisfaction, motivational regulations and physical activity intention among elementary school students. *Educational Psychology*, 34(4), 495-511. <https://doi.org/10.1080/01443410.2013.822959>
- Cosnefroy, L. (2007). Le sentiment de compétence, un déterminant essentiel de l'intérêt pour les disciplines scolaires. *L'Orientation scolaire et professionnelle*, 36/3, 357-378. <https://doi.org/10.4000/osp.1459>
- Flintoff, A., & Scraton, S. (2005). Gender and Physical Education. In *Physical Education : Essential Issues* (p. 161-179). SAGE Publications Ltd. <https://doi.org/10.4135/9781446215876.n10>
- Fontayne, P., Sarrazin, P., & Famose, J.-P. (2001). Les pratiques sportives des adolescents : Une différenciation selon le genre. *Staps*, 55(2), 23. <https://doi.org/10.3917/sta.055.0023>
- Gard, M., & Meyenn, R. (2000). Boys, bodies, pleasure and pain : Interrogating contact sports in schools. *Sport, Education and Society*, 5, 19-34.
- Garn, A. C. (2017). Multidimensional Measurement of Situational Interest in Physical Education : Application of Bifactor Exploratory Structural Equation Modeling. *Journal of Teaching in Physical Education*, 36(3), 323-339. <https://doi.org/10.1123/jtpe.2017-0035>

- Hidi. (2000). An interest researcher's perspective : The effects of extrinsic and intrinsic factors on motivation. In *Intrinsic and extrinsic motivation*. Academic Press, 309-339.
- Hidi, & Renninger, K. A. (2006). The Four-Phase Model of Interest Development. *Educational Psychologist*, 41(2), 111-127. https://doi.org/10.1207/s15326985ep4102_4
- Kermarrec, G., Roure, C., & Pasco, D. (2014). Étude des sources de l'intérêt en situation lors d'activités physiques scolaires chez les garçons et les filles. *Science & Sports*, 29, S18-S19. <https://doi.org/10.1016/j.scispo.2014.08.033>
- Lee, O., Kim, Y., & Kim, B. J. (2012). Relations of Perception of Responsibility to Intrinsic Motivation and Physical Activity among Korean Middle School Students. *Perceptual and Motor Skills*, 115(3), 944-952. <https://doi.org/10.2466/06.10.25.PMS.115.6.944-952>
- Lentillon, V. (2009). Les stéréotypes sexuels relatifs à la pratique des activités physiques et sportives chez les adolescents français et leurs conséquences discriminatoires. *Bulletin de psychologie*, Numéro 499(1), 15. <https://doi.org/10.3917/bupsy.499.0015>
- Lentillon-Kaestner, V., & Cogérino, G. (2005). Les inégalités entre les sexes dans l'évaluation en EPS : Sentiment d'injustice chez les collégiens. *Staps*, 68(2), 77. <https://doi.org/10.3917/sta.068.0077>
- Lentillon-Kaestner, V., & Patelli, G. (2016). Effects of Grouping Forms, Student Gender and Ability Level on the Pleasure Experienced in Physical Education. *Journal of Teaching in Physical Education*, 35(3), 251-262. <https://doi.org/10.1123/jtpe.2014-0216>
- Lentillon-Kaestner, V., & Roure, C. (2019). Coeducational and single-sex physical education : Students' situational interest in learning tasks centred on technical skills. *Physical Education and Sport Pedagogy*, 24(3), 287-300. <https://doi.org/10.1080/17408989.2019.1571186>
- Love, J., Selker, R., Marsman, M., Jamil, T., Dropmann, D., Verhagen, J., Ly, A., Gronau, Q. F., Smíra, M., Epskamp, S., Matzke, D., Wild, A., Knight, P., Rouder, J. N., Morey, R. D., & Wagenmakers, E.-J. (2019). Graphical Statistical Software for Common Statistical Designs. *Journal of Statistical Software*, 88(2). <https://doi.org/10.18637/jss.v088.i02>
- Ottogalli-Mazzacavallo, C., & Szerdahelyi, L. (2019). Annick Davige, une actrice innovante de l'EPS en faveur de l'égalité des sexes (1961-2018). *Staps*, n°123(1), 67. <https://doi.org/10.3917/sta.123.0067>
- Pintrich, P. R. (2002). The Role of Metacognitive Knowledge in Learning, Teaching, and Assessing. *Theory Into Practice*, 41(4), 219-225. https://doi.org/10.1207/s15430421tip4104_3
- Plaza. (2016). *Stéréotypes sexuels explicites et implicites en contexte sportif : Réalité, évolution, et lien avec les comportements d'engagement sportif*. <http://www.theses.fr/2016MONT4003/document>
- Renninger, K. A. (2000). Individual interest and its implications for understanding intrinsic motivation. In *Intrinsic and extrinsic motivation*. Academic Press, 373-404.
- Renninger, K. A., & Hidi, S. (2016). *The Power of Interest for Motivation and Engagement*.
- Rotgans, J. I., & Schmidt, H. G. (2017). The Role of Interest in Learning : Knowledge Acquisition at the Intersection of Situational and Individual Interest. In P. A. O'Keefe & J. M. Harackiewicz (Éds.), *The Science of Interest* (p. 69-93). Springer International Publishing. https://doi.org/10.1007/978-3-319-55509-6_4
- Roure, C., Kermarrec, G., & Pasco, D. (2019). Effects of situational interest dimensions on students' learning strategies in physical education. *European Physical Education Review*, 25(2), 327-340. <https://doi.org/10.1177/1356336X17732964>
- Roure, C., Méard, J., & Lentillon-Kaestner, V. (2017). The Role of PE Teachers in Enhancing Situational Interest Through Video Feedback. *Paper presented at the BERA Conference, Brighton*.
- Roure, C., & Pasco, D. (2018). Exploring situational interest sources in the French physical education context. *European Physical Education Review*, 3-20.
- Roure, C., Pasco, D., & Kermarrec, G. (2016). Validation de l'échelle française mesurant l'intérêt en situation, en éducation physique ; Validation of the French situational interest scale in physical education. *Canadian Journal of Behavioural Science*, 48, 112-120.
- Shen, B., Chen, A., & Guan, J. (2007). Using Achievement Goals and Interest to Predict Learning in Physical Education. *The Journal of Experimental Education*, 75(2), 89-108. <https://doi.org/10.3200/JEXE.75.2.89-108>
- Shen, B., Chen, A., Tolley, H., & Scrabis, K. A. (2003). Gender and Interest-Based Motivation in Learning Dance. *Journal of Teaching in Physical Education*, 22(4), 396-409. <https://doi.org/10.1123/jtpe.22.4.396>
- Smith, M. A., & St Pierre, P. E. (2009). Secondary students' perceptions of enjoyment in physical education : An American and English perspective. *Physical Educator*, 66(4), 209-221.
- Spence, J. T., Helmreich, R., & Stapp, J. (1975). Ratings of self and peers on sex role attributes and their relation to self-esteem and conceptions of masculinity and femininity. *Journal of Personality and Social Psychology*, 32(1), 29-39. <https://doi.org/10.1037/h0076857>
- Williams, A., & Bedward, J. (2001). Gender, Culture and the Generation Gap : Student and Teacher Perceptions of Aspects of National Curriculum Physical Education. *Sport, Education and Society*, 6(1), 53-66. <https://doi.org/10.1080/713696037>
- Zhu, X., Chen, A., Ennis, C., Sun, H., Hopple, C., Bonello, M., Bae, M., & Kim, S. (2009). Situational interest, cognitive engagement, and achievement in physical education. *Contemporary Educational Psychology*, 34(3), 221-229. <https://doi.org/10.1016/j.cedpsych.2009.05.002>