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Effect of the Jigsaw Method on Self-Reported Practices by Physical Education Teachers: A Textual Analysis

Océane Cochon Drouet ^{1,2,*} , Patrick Fargier ¹, Nicolas Margas ² and Vanessa Lentillon-Kaestner ¹

¹ Teaching and Research Unit in Physical Education and Sport, Canton de Vaud, (HEP-VD), University of Teacher Education, 1007 Lausanne, Switzerland; patrick.fargier@hepl.ch (P.F.); vanessa.lentillon-kaestner@hepl.ch (V.L.-K.)

² Institute of Sport Sciences, University of Lausanne, 1015 Lausanne, Switzerland; nicolas.margas@unil.ch

* Correspondence: oceane.cochon-drouet@hepl.ch

Abstract: Jigsaw is a cooperative teaching method that is easy to implement and may engage teachers who use it. Previous studies have mainly focused on the effects of the Jigsaw method on students and rarely on teachers. The present study aimed to determine whether Jigsaw implementation influenced the discourses of physical education (PE) teachers related to their teaching practices. Six volunteer teachers used the Jigsaw method during three PE teaching sequences with various physical activities practiced, and semi-directive interviews were conducted before and after the Jigsaw implementation. Each interview was recorded and transcribed with the aim of performing textual analysis using Alceste2018[®]. The qualitative content analysis performed from the outputs of the automatic textual analysis led to determine the emergent themes in the interviewees' discourses and the focuses used to address these themes, before and after the Jigsaw implementation. The themes in the discourses were found to be teacher-centered before the Jigsaw implementation (e.g., the guidelines and principles for teaching) and student-centered after the implementation (e.g., the student activity during learning). The focuses were found to vary accordingly (e.g., teachers' intentions, before the implementation, and students' characteristics, after the implementation). Such changes in the teachers' discourse thus suggest that the Jigsaw method might be a useful tool for the development of teaching practices.

Keywords: Jigsaw method; physical education teachers; teaching practices; teaching conceptions; textual analysis



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1. Introduction

The present study aimed to explore and compare PE teachers' self-reported practices before and after the implementation of three Jigsaw sequences. Previous studies on cooperative learning have focused mostly on its effects on student outcomes (i.e., achievement, motivation, attitudes, social relationships, and self-esteem) [1–3] but rarely on its effects on teachers who implemented the cooperative learning [4,5] or Jigsaw method [6–9]. Notably, these previous studies focused on the effects of the Jigsaw method on teachers after only one Jigsaw sequence. The effect of the implementation of several Jigsaw sequences on teacher practices and perceptions needs to be further explored.

1.1. Cooperative Learning and Teaching Practices

Cooperative learning is a pedagogical strategy in which students work in small groups [10] to improve social relations and to learn [10]. Five characteristics of cooperative learning are central in this approach: (1) positive interdependence among the group members; (2) the individual responsibility for each member of the group to improve peers' skills by sharing his or her knowledge; (3) essential “face-to-face” interactions to promote the success of everyone with help, support, and encouragement; (4) development of social skills that include leadership, decision-making, the construction of a climate of confidence,

and the ability to communicate and negotiate to resolve conflicts; and (5) development of a group dynamic based on shared common goals to learn and succeed [10]. The benefits of cooperative learning have been well established [10,11], and the literature has shown positive effects on several student outcomes: achievement, motivation, attitudes, social relationships, and self-esteem [1,2]. These benefits may encourage teachers to implement cooperative methods in their classes. However, according to Pianta et al. [12], in 2007 only 10% of teaching time was dedicated to cooperative methods in American classrooms. In addition, studies suggest that introducing cooperative methods may constitute a challenge that requires an investment of time and energy into changing teaching strategies [13]. When teachers use cooperative learning methods, they are required to identify specific learning objectives and outcomes, to create specific resources, and to organize and manage students' groups [5]. Moreover, teachers need to consider how much information should be given to students and how to give feedback. By implementing cooperative learning methods, teachers need to change their posture and habits in teaching practices, and transfer responsibilities to students, which can lead to feelings of a loss of control and work overload. In this way, training teachers to use cooperative methods is essential to sustain them in these practice changes [14,15]. In the study of Volpé and Buchs [4], teachers were introduced to cooperative education during a one-day training session, followed by two half-days allowing teachers to experiment in class. After training, teachers were interviewed, and they reported difficulties managing time and operationalizing positive interdependence. However, the results from Goodyear [5] suggest that such difficulties may be overcome with time, experience, and support, as teachers progressively adapt cooperative learning methods to students' learning needs. Pedagogical training followed by the implementation of cooperative learning over several sequences could be beneficial in encouraging changes in teaching practice.

1.2. The Jigsaw Method

The Jigsaw method [16] was initially developed to transform competitive classrooms into cooperative classrooms and to reduce negative attitudes toward stigmatized groups [13]. The Jigsaw method may seem simple when presented [17], as it includes four implementation steps. In step 1, groups of four to eight students are constituted as "home groups"; the students in each home group are heterogeneous, and the home groups are homogeneous among them. In step 2, expert groups are constituted that include students from each home group; each expert group must learn to achieve a task that is different from the task learned in another expert group. In step 3, each student is responsible for teaching the task learned in his or her own expert group to the home group peers. Finally, in step 4, the home group students must collectively achieve a final task that requires mastery of this series of tasks; the achievement of the final task is evaluated [18].

The Jigsaw method requires teaching practices that break with frontal teaching methods [15]. It has been shown that the Jigsaw method requires time for successful implementation, and its execution is improved by specific training in its use. Bratt [19] suggests a 2-day training session for teachers and follow-up meetings after weeks of using the Jigsaw method (see also [17,18]).

Few studies have focused on teachers after the implementation of the Jigsaw method in PE [6–9]. More precisely, some studies have examined the perceptions of the Jigsaw method among teachers who had not yet experienced the method [8], while others compared the perceptions of the method among teachers who had experienced it during one sequence to the perceptions of teachers who had not [9]. Other studies simply focused on teachers' perceptions after the implementation of a Jigsaw sequence without a control group [6,7]. In the study of Ghaith [8], most of the participants shared positive feelings about the Jigsaw method after a 3-day workshop on cooperative learning methods. The results of Escalié and Legrain [6] and Escalié et al. [7] showed that teachers appreciated the different training times and their autonomy in the implementation of the Jigsaw method after training, even if they underlined the complexity in designing and implementing this method. The results

found by Nalls [9] confirmed that the Jigsaw method may be considered attractive by teachers, but they also highlighted difficulties in implementing the method, especially regarding student management. Studies focusing on preservice teachers also reported such difficulties [20–23].

Overall, the literature showed that teachers may consider Jigsaw attractive but difficult to implement. Further studies are needed to clarify the effects. The present study thus aimed to compare self-reported practices by PE teachers before and after the implementation of three Jigsaw sequences.

2. Materials and Methods

2.1. Participants

The sample consisted of six PE teachers (two women and four men; $M_{age} \pm SD = 36.00 \pm 6.35$) with teaching experience ranging from two to fifteen years. These teachers taught in middle schools in France; only two of them taught in the same school. Class sizes ranged from 21 to 27 students. Permission to conduct the study was granted by the Ethics Board of the host university and was obtained from the headteachers of the participating schools, PE teachers, students' parents, and students themselves.

2.2. Research Protocol

A total of 6 classes were involved in the Jigsaw sequences ($n = 254$, 126 girls and 128 boys). All PE sequences included eight lessons, and each lesson lasted 110 min. Six lessons were dedicated to learning, and the two following lessons were dedicated to evaluation of the students. Different physical activities were taught during the PE sequences (i.e., relay speed in track and field, climbing, gymnastics, badminton, handball, volleyball).

2.2.1. Teachers' Training Organization

The teachers were trained to use the Jigsaw method following the recommendations from Bratt [19] (i.e., a 2-day training session for teachers and follow-up meetings after weeks of using Jigsaw), and the same training program was used as in the study of Cochon Drouet et al. [18]. All the participants in the study completed the full training.

2.2.2. Jigsaw Sequences

After training, each teacher designed the Jigsaw sequences in co-reflection with the same researcher [20,24]. For all Jigsaw classes, the Jigsaw steps (detailed in the introduction) were followed. At the beginning of each sequence, the PE teachers formed home groups. Each home group included four students; the home groups were homogeneous at the group level, and each home group showed heterogeneity in relation to the students' sex and ability level in the physical activity taught. Each home group warmed up for 10–15 min during each lesson, and then the teacher formed expert groups. For example, during the artistic gymnastics' sequence, each expert group learned a technique (e.g., forward roll or handstand) different from those learned in the other expert groups. The teachers chose the learning content based on the students' ability levels. Each student in each expert group spent 15–20 min learning a specific task and was instructed to be prepared to teach the learned task to the other members of the home group. Such peer teaching lasted approximately 40 min; then, the home group was engaged for 10–15 min in the preparation of a collective production (e.g., a series of gymnastic figures) that required the performance of each piece of content previously learned during the lesson.

2.2.3. Fidelity of Intervention

The fidelity of Jigsaw implementation was verified through observations during two lessons (i.e., lessons three and six) in each sequence and each class. For each observed lesson, the fidelity of each element of the Jigsaw method (i.e., Jigsaw steps, positive interdependence within Jigsaw groups, individual responsibility, student interactions, common purpose, and peer work) was assessed separately by two researchers using the same coding

system. This coding system consisted of three letters indicating the fidelity of the intervention (A = high fidelity, B = good fidelity, or C = low fidelity). The results of the coding system showed a high level of intervention fidelity with A scores systematically awarded for all items.

2.3. Semi Structured Interviews

Two semi-structured interviews were conducted with each teacher, one before the training phase and one after the implementation of the three Jigsaw sequences. The choice to conduct semi-structured interviews was made because the study required free expression on predetermined topics [25], i.e., (1) the teacher's activity when designing a PE lesson and (2) when teaching such a lesson, (3) the student activity intended to meet different teaching objectives (attitude, social roles, autonomy, etc.), and (4) teaching methods. For each topic, before and after the Jigsaw implementation, an open question was first systematically asked to address the topic. For example, regarding topic (1) and before the Jigsaw implementation, each interviewee was asked the following question: "What do you usually do to prepare a PE lesson and/or a series of PE lessons?"; a similar question was asked after the Jigsaw implementation: "What did you do to prepare a PE lesson and/or a series of PE lessons using the Jigsaw method?". The purpose of the interviewer was to let the interviewee develop his or her discourse as much as possible, provided that the discourse was addressing the topic (1). The topic to be taken into consideration was repeated when it was necessary. Depending on the interviewee's discourse, questions were also asked to help him/her to develop the discourse in more depth than previously. This was systematically performed using elements in the interviewee's discourse, e.g., "You have just said that you first define the objectives of the lesson. Would you please explain to me what you exactly did to define such objectives?". In addition, the interviewee was asked to give examples and/or to report a peculiar experience regarding elements that he or she had previously addressed, e.g., "Could you please describe as precisely as possible the expected behaviors of students regarding the cooperation objective that you have mentioned?". This questioning logic was repeated for each of the four considered topics.

2.4. Content Analysis

Each interview was recorded and transcribed with the aim of performing textual analysis using Alceste2018[®] (Education edition), software well suited to analyze discourses produced at the reaction level as defined by Tremblin et al. [26]. The verbatim transcriptions were distributed in two distinct corpora that included the discourses of each teacher before (Corpus 1) and after (Corpus 2) Jigsaw implementation. For each corpus, the textual analysis using Alceste software required five main steps (e.g., [27–29]): (1) Presentation of the transcriptions in a single plain text file, using the ad hoc code to identify each interview; (2) Determination of the lexemes to be analyzed (from the identification of the corpora words, using an internal dictionary and a disambiguation procedure to analyze polysemic words in textual context), and lemmatization (production of reduced forms from initial full words; e.g., work+); (3) Determination of the lexical categories in the corpus by hierarchical descending classification (HDC) based on the presence vs. the absence of each lexeme in each elementary unit of context (EUC, i.e., text fragments automatically determined by the software, two EUC lengths being systematically used to compute two HDCs with the intent to determine whether the HDC results were, or not, influenced by the EUC length); (4) From the HDC results, production of a factorial correspondence analysis (FCA) leading to highlighting the relative similarity or dissimilarity of each lexical category to the others; (5) Presentation of the lexical categories determined with, for each category, a series of significantly associated lexemes (by Chi-square of association) and a series of typical EUCs (determined by the computation of coefficients derived from Chi-square).

From the outputs given by Alceste and for each corpus, a qualitative content analysis (e.g., [30]) with an inductive approach [31] was performed with the aim of determining the main theme of the discourse in each series of typical EUCs. For each lexical category, the

overall consistency was verified between the main theme in each series of typical EUCs and the associated lexemes. On this basis, the results of the FCA were used to clarify the determinants of the relative similarity or dissimilarity of each lexical category to the others. This allowed comparison between Corpora 1 and 2 to determine possible evolution in the subjects' discourses from one corpus to the other.

A complementary content analysis was performed to determine the focuses used to address the themes previously identified in Corpora 1 and 2. For each corpus, the occurrence of each focus was further quantified considering (1) the number of EUCs including the focus and (2) the number of subjects using this focus. For each type of quantification, Spearman's correlation coefficient was computed for the data distributions for Corpora 1 and 2, to verify the possible evolution of the focuses from one corpus to the other.

3. Results

For Corpora 1 and 2, the HDCs covered 61% and 66% of the EUCs (above the 50% threshold), respectively. In addition, these HDCs showed weak sensitivity to the EUC length (see the dendrograms, Figure 1). This led us to consider the lexical categories determined by HDC as reliable (four categories in Corpus 1 and three in Corpus 2).

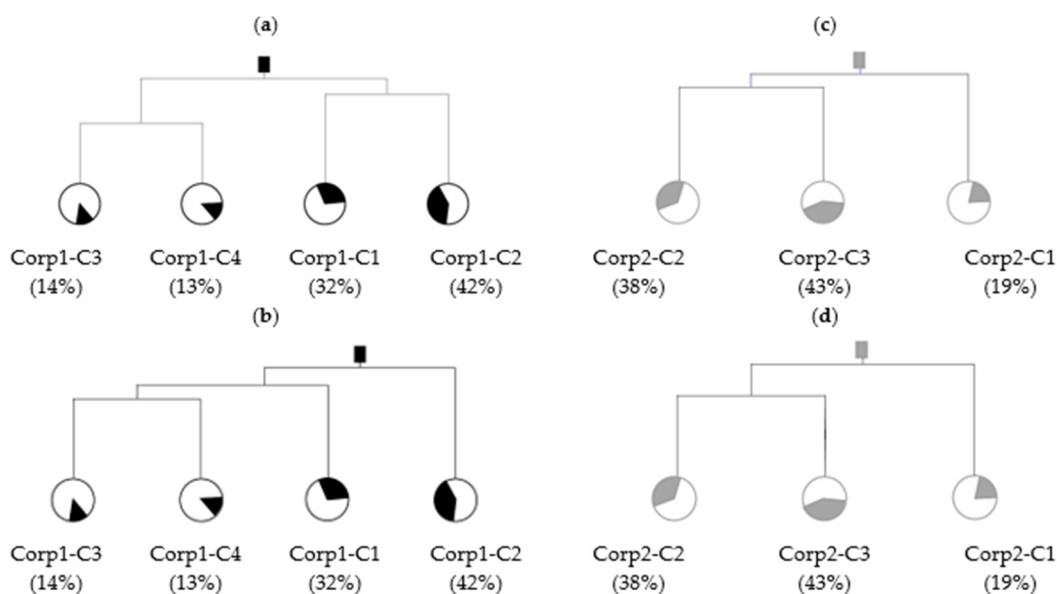


Figure 1. Hierarchical descending classifications (HDCs) for Corpora 1 and 2. (a). HDC1 for Corpus 1; (b). HDC2 for Corpus 1; (c). HDC1 for Corpus 2; (d). HDC2 for Corpus 2.

Figure 1a,b show the steps and the outputs of the two HDCs computed by Alceste for Corpus 1 when giving two different lengths to the elementary units of context (EUCs, i.e., text fragments). HDCs 1 and 2 led to different outputs at the first bipartition level (from a total of 95 classified EUCs: ϕ). However, the following bipartitions had similar outputs. From one HDC to the other, the four identified lexical categories (Corp1-C1 to Corp1-C4 in Figure 1a,b, with the percent of EUCs for each Corp-C) showed similar lexical proximities or dissimilarities with the exception that Corp1-C1 was closer to Corp1-C2 in HDC1 than in HDC2. Overall, this suggests that the HDC had weak sensitivity to the EUC length. Figure 1c,d show similar elements when considering the successive bipartitions (a total of 163 classified EUCs: ϕ) leading to the three lexical categories in Corpus 2 (Corp2-C1 to Corp2-C3).

3.1. Lexical Categories and Themes Addressed in the Typical EUCs

Examples of the lexical forms associated with the four lexical categories found in Corpus 1 and with the three categories found in Corpus 2 are given in Table 1.

Table 1. Lexical forms in the lexical categories for Corpora 1 and 2.

Lexical Categories in Corpus 1				Lexical Categories in Corpus 2		
Corp1-C1 (1 to 13)	Corp1-C2 (1 to 19)	Corp1-C3 (1 to 26)	Corp1-C4 (1 to 22)	Corp2-C1 (1 to 59)	Corp2-C2 (1 to 16)	Corp2-C3 (1 to 19)
Desire (13)	Situation (19)	Whistle (26)	Gym (22)	Lesson (59)	Sheet (16)	Class (19)
Able (11)	Lesson (15)	Organize (13)	Material (22)	Warm-up (23)	Group (11)	Jigsaw (17)
Competence (11)	Times (11)	Voice (10)	Utilization (21)	Global (22)	Belonging (10)	Action (13)
Different (9)	Game (9)	Sit (7)	Team (15)	Autonom+ (19)	Step-back (7)	Understood (11)
Interesting (9)	Beginning (9)	Collective (7)	Alone (14)	Motor (13)	Relay (7)	Game (10)
Motor (7)	Put (9)	Grouping (7)	Video (11)	Content (13)	Surprise (7)	Positive (10)
Sequence (7)	Action (7)	All (5)	Using (9)	Sequence (12)	Position (7)	Function (8)
Social (6)	After (6)	Alone (5)	Sport (8)	Think (8)	Mode (6)	Logic (7)
Work+ (6)	Say+ (6)	Group (3)	Instruction (8)	Time (6)	Posture (5)	See (7)
PE (4)	End+ (4)	Class (2)	Evaluation (8)	Need (6)	Learn (5)	Situation+ (7)

Examples of the lexical forms included in each lexical category determined by Alceste are shown in the table (Corp1-C1 to Corp1-C4 for Corpus 1 and Corp2-C1 to Corp2-C3 for Corpus 2). For each lexical category, the range of the Chi-square values are given (in brackets), and the lexical forms are ranged in decreasing order by the obtained values of the Chi-square (given in brackets).

Each typical EUC linked to a lexical category naturally includes lexical forms associated with this category (examples of such lexical forms are given Table 1). Consequently, for each lexical category, the typical EUCs may be analyzed to determine a theme that may be confirmed when examining the lexical forms. For Corpora 1 and 2, the themes found by content analysis of the typical EUCs are shown in Table 2.

For Corpora 1 and 2, Table 2 shows examples of the typical elementary units of context (EUCs, i.e., text fragments) linked to each lexical category determined by Alceste. The underlined words are also listed in Table 1. For each category, the total number of typical EUCs (n) and the range of the coefficients (derived from Chi-square values) measuring the typicality of the EUCs are given (the greater the coefficient value is above 0, the more the EUC is typical). Each example was chosen among five relatively typical EUCs in the considered category. The themes determined by content analysis of the typical EUCs are finally shown. For example, considering Corp1-C1, the discourse in the typical EUCs was aimed at clarifying teaching goals (e.g., motor skill competence as an important teaching goal) or at describing teaching habits (e.g., promotion of a climate of trust). This led to the conclusion that the typical EUCs linked to Corp1-C1 had the guidelines and principles for teaching as their main theme. The other themes were identified using a similar approach.

In Corpus 1, the themes of the typical EUCs linked to the lexical categories Corp1-C1 to Corp1-C4 were (1) the guidelines and principles for teaching, (2) the structure of PE lessons and sequences, (3) the supervision of tasks during PE lessons, and (4) the management of students during PE lessons (Table 2).

Table 2. Themes in the typical EUCs for Corpora 1 and 2.

Corpus 1				
Categories	Examples of typical EUCs	<i>n</i>	Coefficient	Themes
Corp1-C1	“Rather <u>motor</u> skills competence, this is an important teaching goal, but I try to teach each <u>social</u> skill that I consider of importance to place the students in a <u>social working</u> environment that they enjoy”	20	2 to 27	Guidelines and principles for teaching
Corp1-C2	“... by practicing games. Dance lessons systematically include a <u>final</u> phase for viewing; the way to teach it depends on the students’ level in the physical activity taught. However, there is always a warm-up, the core <u>lesson</u> that includes a learning <u>situation</u> , followed by a restitution phase at the <u>end</u> of the <u>lesson</u> .”	21	2 to 13	Structure of the PE lessons and sequences
Corp1-C3	“I prefer to use my <u>voice</u> ; I rarely use my <u>whistle</u> . Sometimes I use it with the aim to group the students when they are dispatched. I do use sometimes my <u>whistle</u> , or the <u>voice</u> ; I also use gestures, a little bit, visual elements.”	12	1 to 38	Task supervision during the PE lessons
Corp1-C4	“They wished to succeed. I often form affinity groups but when I teach a collective sport, I try to form homogeneous teams, with each team including heterogeneous students. Most of time, I prefer forming affinity groups for students’ enrollment. Media, notably <u>video</u> , should be used more often.”	12	1 to 21	Managing students during the PE lessons
Corpus 2				
Categories	Examples of typical EUCs	<i>n</i>	Coefficient	Themes
Corp2-C1	“It was pretty good at the beginning of the <u>lessons</u> . At the beginning of each new <u>lesson</u> I told to myself that they seemed well; they are <u>autonomous</u> . Usually the <u>lessons</u> started rather well, then I gradually had to do a lot to ensure discipline.”	20	8 to 41	Student activity during learning
Corp2-C2	“I saw that when they practiced <u>relays</u> and other activities, some students joined their <u>expert</u> group. It was necessary to reexplain to them what they will have to do in their [home] <u>group</u> , as they had not understood the initial instructions.”	20	6 to 18	Group aspects during learning
Corp2-C3	“They saw an aspect of what may be considered dance, and they have <u>understood</u> many things. [There is a] logic in the <u>situational</u> interest. I was always saying that we were going to realize a project and not to practice dance.”	20	6 to 18	Teaching–learning follow-up by the teacher

Accordingly, the lexical forms associated with the categories Corp1-C1 to Corp1-C4 (Table 1) may be used to describe (1) learning goals or elements favoring efficient teaching (e.g., “competence”, “motor”, “social”, “desire” in Corp1-C1), (2) the structure of PE courses (e.g., “situation”, “lesson”, “beginning”, “after” in Corp1-C2), (3) the organization of learning tasks (e.g., “whistle”, “organize”, “voice”, “grouping” in Corp1-C3), and (4) students’ support (e.g., “material”, “video”, “instruction”, “evaluation” in Corp1-C4).

In Corpus 2, the themes of the typical EUCs linked to the lexical categories Corp2-C1 to Corp2-C3 were (1) student activity during learning, (2) group aspects during learning, and (3) learning–teaching follow-up by the teacher (Table 2).

This is consistent with the lexical forms associated with categories Corp2-C1 to Corp2-C3 (Table 1), which may be used to describe (1) activities during PE lessons (e.g., “warm-up”, “autonomy+”, “motor”, “think” in Corp2-C1), (2) collective learning during PE lessons (e.g.,

“sheet”, “group”, “belonging”, “relay” in Corp2-C2), and (3) teaching–learning analysis (e.g., “class”, “situation”, “jigsaw”, “positive” in Corp2-C3).

3.2. FCA and the Discursive Universe of the Interviewees

The computed FCAs, from the HDCs results, allowed clarification of the proximity and dissimilarity of each lexical category to the others in Corpora 1 and 2 (see Figure 2).

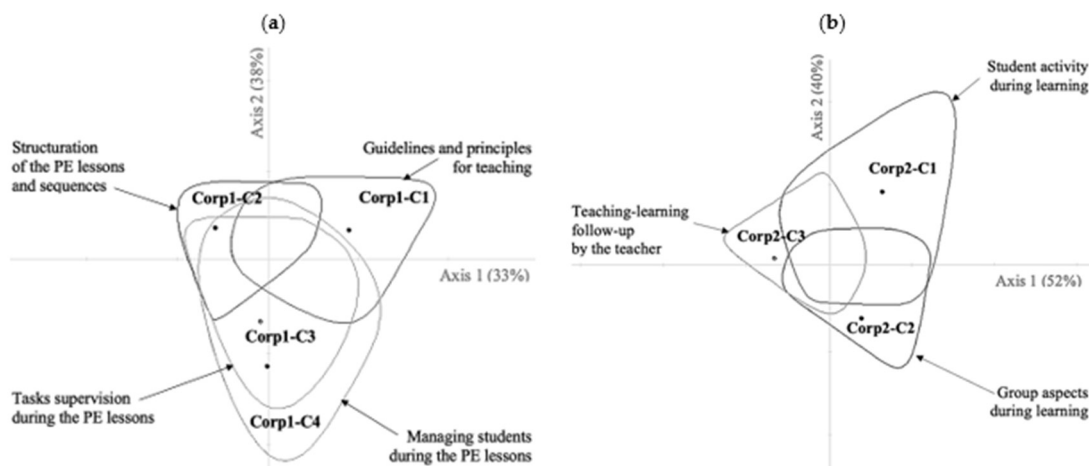


Figure 2. FCA, lexical categories, and EUC themes in Corpora 1 and 2. (a). Corpus 1; (b). Corpus 2.

For Corpus 1 (Figure 1a) and Corpus 2 (Figure 1b), each lexical category determined by Alceste (Corp1-C1 to Corp1-C4 in Corpus 1 and Corp2-C1 to Corp2-C3 in Corpus 2) was positioned relative to the others (by FCA) in a system of two axes. Consequently, the proximity–dissimilarity of each category to another depended on their relative positions regarding each of the two axes. For each lexical category, the theme of the discourses in the typical EUCs is also indicated (linked to the category by an arrow).

For Corpus 1 (Figure 2a), the relative positions of the lexical categories suggest that the interviewees’ discourse was limited to content between (1) the poles of the teacher background for teaching (Corp1-C1 and Corp1-C2) and of the implementation of the lessons (Corp1-C3 and Corp1-C4) and (2) the poles of didactics (Corp1-C2) and of pedagogy (Corp1-C1), with two categories sharing an intermediate position (Corp1-C3 and Corp1-C4).

Another discursive universe was found in Corpus 2 (Figure 2b) with discourses on teaching–learning activity rather than on conceptions of teaching practices. In Corpus 2, the discourses were limited to content between (1) the poles of individual learning and of group activity during learning (Corp2-C1 and Corp2-C2 being in proximity to the first pole and the second pole, respectively; Corp2-C3 having an intermediate position) and (2) the poles of the teacher’s activity (Corp2-C3) and of the students’ activity regarding learning (Corp2-C1 and Corp2-C2).

3.3. Focuses Used to Develop the Discourses in Corpora 1 and 2

As a complement, thematic content analysis was performed to determine the focuses used by the interviewees to address the theme of each series of EUCs in Corpora 1 and 2.

This led to the determination of five focuses that were used in EUCs linked to different lexical categories in the two corpora: (1) teacher’s intentions, (2) teaching contents and methods, (3) collective organization, (4) students’ characteristics, and (5) jigsaw effects on students. For example, Focus (3) was used in Corp1-C2 (theme of the category: structure of the PE lessons and sequences) in an EUC developing a discourse on general methods for organizing a lesson: “... rarely individually, in fact. I’m often grouping two students—one of them observes and has to give feedback, or at the beginning of some learning phases, but most of time they are grouped by two”. The same focus was also used in Corp2-C3 (theme of the category: group aspects during learning) in an EUC developing a discourse on the interactions among students during a dance session: “Maybe the necessity to cooperate

in groups made it easier for the students to listen to each other. Inside the group, it was always positive because it was for their choreography, the interactions were linked to the activity in the class. Yes, I found her less aggressive, I found them less aggressive". More examples of the five focuses determined are given in Table 3.

Table 3. Focuses addressing the themes of the discourses in Corpora 1 and 2.

Categories	Examples of EUCs	Focuses
Corp1-C1	"As a teacher, in my opinion, ethical values require me to place students in a climate of trust for learning and to develop self-confidence, then, there's something like that."	Teacher's intentions.
Corp1-C3	"No, I don't use devices with this goal. I will quote my colleague from the outdoor physical activity group: together we go further but slower, alone we go faster but less far."	
Corp1-C2	"Yes, in particular there. Learning all the rules of the game, this seems to me very important at a cultural level. In addition, each time we practice rugby, teaching adaptations are necessary, however, it is important to keep in line with the culture of the activity."	Teaching contents and methods
Corp2-C1	"They were instructed to climb a route, then, if they had climbed mid-way or if they had reached the top of the route, they had to report the color of the climbing holds that they had used; progressively, things were added to that."	
Corp1-C2	"... rarely individually, in fact. I'm often grouping two students, one of them observes and must give feedback, or at the beginning of some learning phases, but most of time they are grouped by two."	Collective organization
Corp2-C3	"Maybe the necessity to cooperate in the groups made it easier for the students to listen to each other. Inside the group, it was always positive because it was for their choreography, the interactions were linked to the activity in the class; yes, I found her less aggressive, I found them less aggressive."	
Corp2-C1	"It was me Mister, I'm OK to climb but I don't want to climb with her. Consequently, it took work to correct this point and then it turned out she wasn't playing her part; it was necessary to encourage her, and it worked."	Students' characteristics
Corp2-C2	"I even spoke about this to her mother. It has been difficult for her because she conflicted with Ilona. In addition, something else happened at the group level."	
Corp2-C2	"I saw that when they practiced relays and other activities, some students joined their expert groups; it was necessary to reexplain to them what they will have to do in the group, as they had not understood the initial instructions."	Jigsaw method
Corp2-C3	"I didn't notice major changes in their behavior during the year. With the jigsaw class, most students played the role of expert correctly and I think that the girls were truly interested."	

Examples of focuses used to address the themes of the EUCs linked to the lexical categories in Corpora 1 (Corp1-C1 to Corp1-C4) and 2 (Corp2-C1 to Corp2-C3) are given.

The use of each focus was quantified in Corpora 1 and 2 considering (1) the number of EUCs that included the focus and (2) the number of interviewees using the focus (see Figure 3).

The five focuses were teacher's intentions (1), teaching contents and methods (2), collective organization (3), students' characteristics (4), and the Jigsaw method (5). For Corpora 1 and 2, the use of each focus was quantified depending on the number of typical EUCs including the focus (Figure 3a) and depending on the number of interviewees using the focus (Figure 3b).

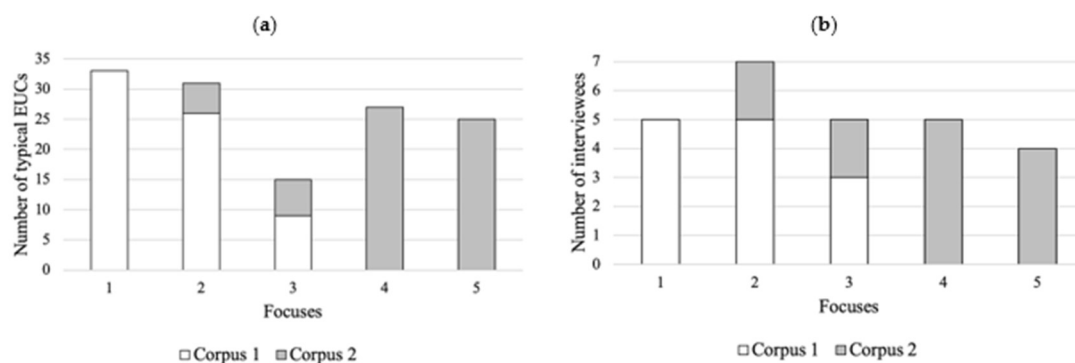


Figure 3. Focuses used in Corpora 1 and 2. (a). Quantification 1; (b). Quantification 2.

Using the first quantification of focuses (Figure 1a) and the second (Figure 1b), the Spearman's coefficients of correlation between the data distributions for Corpora 1 and 2 were $Rho = -0.947$ ($p = 0.014$) and $Rho = -0.892$ ($p = 0.042$), respectively. Consequently, it may be concluded that the focuses addressing the main themes in the discourses significantly varied from Corpus 1 to Corpus 2.

4. Discussion

4.1. Change in the Discursive Universe

The present study examined the discourses of PE teachers before and after implementation of the Jigsaw method during three teaching sequences. Textual and content analyses showed that the discourses after implementation differed from the discourses before implementation. Before implementation, the main themes in the discourses (Corpus 1) were (1) the guidelines and principles for teaching, (2) the structure of the PE lessons and sequences, (3) the task supervision during the PE lessons, and (4) the management of the students during the PE lessons (see Table 2). After the implementation of the Jigsaw method, the main themes in the discourses (Corpus 2) were (1) the student activity during learning, (2) group aspects during learning, and (3) the learning-teaching follow-up by the teacher (see Table 2). The discursive universe in Corpus 1 was thus found to differ significantly from the discursive universe in Corpus 2 (see Figure 2).

The focuses used to address the themes in the discourses were also found to vary from Corpus 1 (discourses before the Jigsaw implementation) to Corpus 2 (discourses after the Jigsaw implementation). Considering the two corpora, a total of five focuses were identified: (1) teachers' intentions, (2) teaching contents and methods, (3) collective organization, (4) students' characteristics, and (5) the Jigsaw method (see also Table 3). Each focus was quantified in Corpora 1 and 2 by the number of occurrences and the number of interviewees using it. Both quantifications led to the observation that Focus (1) and Focus (2) were overused in Corpus 1, while Focus (4) and Focus (5) were overused in Corpus 2. Moreover, both quantifications of each focus led to data distributions for Corpora 1 and 2 showing a statistically significant negative correlation (see Table 3).

In sum, the discourses before the Jigsaw implementation were teacher-centered and limited to generic elements characterizing the teaching method, while after the Jigsaw implementation, the discourses were more learner-centered, taking into consideration the students' learning activity and its support and follow-up by the teachers. This result is consistent with the findings in O'Leary et al. [20] showing that the Jigsaw method challenges teachers at the management level of learners' activity.

In the present study, the development observed in the teacher discourses might suggest a conceptual change among teachers, from a frontal teaching method (e.g., [32]) to a conception of the teacher as a facilitator and/or a guide during learning [33–35]. This might elicit improvement in teaching practices, as it has been argued that a learner-centered approach, in which the teacher acts as a moderator of the students' learning activity, may favor more efficient learning than a traditional approach [33,34]. Such a learner-

centered approach might notably induce students' self-regulation, leading to in-depth learning [34,35].

4.2. Development in Teacher Practices

The results of the present study showed that the implementation of the Jigsaw method may lead teachers to consider their teaching activity as dependent on students' actual activity during learning. This suggests that the implementation of the Jigsaw method might elicit a development in the teachers' practices, as the discourses were initially centered on their own teaching, disregarding the learners' activity.

Such a change may have been favored by the training in the Jigsaw method before its implementation and by the participants' initial interest in this method. According to Rovegno and Bandhauer [36], the change process is fostered by five elements: (1) possessing appropriate content knowledge to implement change appropriately, (2) accepting that change is difficult and may require seeking clarification, (3) implementing change practices aligned with sound philosophy and theory, (4) creating a willingness to explore change and new ideas, and (5) suspending judgment on new ideas. In the present study, the training in the Jigsaw method was in line with elements (1) and (3) mentioned above. Elements (2), (4), and (5) may also have been present, as the teachers participating in the study were volunteers and interested in the Jigsaw method as in the study of Escalié et al. [7].

In the present study, the participants had time to become used to the Jigsaw method and improve its implementation, as they used the method during three PE sequences. This might have contributed to the observed changes in the self-reported practices of the teachers. After three Jigsaw sequences, the teachers' discourses showed habituation to the Jigsaw method. They focused more on the adaptation of their teaching to the students' learning needs [37]. Time is required to understand how the method works in practice and to implement it with efficiency [13]. When implementing a new method, habituation and repetition are also necessary for students. This is notably supported by the results of Cochon Drouet et al. [16] showing an increase in MVPA values in students after a series of PE lessons with the Jigsaw method. Regardless of the physical activity taught, by implementing various Jigsaw sequences, teachers become accustomed to the method and its underlying principles, becoming more comfortable and able to adjust the content to students' learning needs [5].

4.3. Supporting Sustainable Change

In the present study, the teachers were initially instructed on the knowledge and skills required to use the Jigsaw method, which is essential for efficient training, according to Lopata et al. [38] and Gillies [39]. In particular, the continuous support of teachers is a lever to change their teaching practices [5]. During the present study, the teachers were helped in conceiving the PE sequences, and informal and autonomous accompaniment was organized thereafter (answers to teacher questions during the sequences that followed). However, other possibilities to support teaching changes may be used [40,41].

According to Sabourin and Lehraus [15] and considering the results of Goodyear [5] and O'Leary et al. [20], training linked to actual teaching practices may favor teacher development. Consequently, action research, defined as a process of self-reflective practice conducted in social contexts with the aim of improving practice [32], might sustain teacher development in relation to the implementation of the Jigsaw method.

5. Limitations and Future Research

The results of the present study were based on the Alceste method. Consequently, such results depend on a co-occurrence analysis that might show some limitations [42].

The present study focused on the self-reported practices of PE teachers. It would be interesting to compare these data with the actual practices in the same teachers. Actual practice and self-reported practices may differ [6].

In accordance with Goodyear, it would be interesting to determine whether the changes found in the present study might persist.

Finally, in complement to interviews, it would be interesting to assess the development of teaching priorities following the training and implementation of the Jigsaw method during various PE sequences, e.g., by using the OVEPS questionnaire, as in the study by Drouet et al. [43].

6. Conclusions

This study examined the discourses of PE teachers concerning their teaching practices before and after being trained in the Jigsaw method and having implemented this method. The results showed a change in the discourses from a teacher-centered posture to an increased learner-centered posture. The present study showed that the use of the Jigsaw method may be a trigger for change in teachers' reported practices. Further studies are needed to better understand the sustainability of these self-reported changes and their relationships with actual practices in classes.

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