

European Journal of Psychology of Education
2009, Vol. XXIV, n° 2, 145-154
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Is a partner's competence threatening during dyadic cooperative work? It depends on resource interdependence

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Previous studies with university students have shown that resource interdependence during cooperative dyadic work on texts produces two different dynamics in student interaction and learning. Working on complementary information produces positive interactions, but a good quality of information transmission is needed to foster student learning. Working on identical information produces a confrontation of viewpoints but also encourages a threatening social comparison of competence, which can be detrimental for learning. The aim of present study is to test the moderating role of a partner's competence in two peer-learning methods by manipulating a partner's competence through a confederate. Results indicate that a partner's competence is beneficial when students work on complementary information while it is detrimental when students work on identical information.

Peer collaboration and cooperation is encouraged by many researchers and teachers (Sharan, 1999; Topping, 2005) in a variety of settings from primary school (Johnson, Johnson, & Johnson Holubec, 1998; Kutnick, Blatchford, & Baines, 2002; Stevens & Slavin, 1995) through secondary school (Gillies, 2004; Kutnick, Blatchford, Clark, MacIntyre, & Baines, 2005) to post-secondary school and university (Johnson & Johnson, 2002; Johnson, Johnson, & Smith, 2007; O'Donnell, 1999). In the recent *Handbook of the Teaching of Psychology*, cooperative learning is even proposed as a tool to maximize students' potential for success (Vazin & Reile, 2006). In sum, cooperative learning has been consistently shown to be beneficial both for cognitive and for social and motivational outcomes (Johnson & Johnson, 2005; Stevens & Slavin, 1995). However, many cooperative methods exist (Sharan, 1999), and there is no evidence that one method is more efficient than another is for any outcome or situation.

This research was part of Céline Buchs' doctoral work under the supervision of Fabrizio Butera and Gabriel Mugny, and was supported by the Swiss National Science Foundation. The authors would like to acknowledge Emilie Akli and Dominique Pomier for their participation in the data collection for this study.

This paper aims at investigating the conditions that make peer learning effective as a function of resource interdependence, that is, whether the members of a cooperative group all possess the same information or have different complementary pieces of information. It is important to note that the distribution of resources – in particular, information – creates different profiles of competence within the group. If the members possess unique and complementary pieces of information, each member is supposed to be competent for his/her own piece of information. If all the members possess all the information, they are a priori competent about the whole information.

The next section will summarize the consequences of such a distribution of resources, mainly for dyadic groups; it will also show that extant research has systematically considered competence only as a consequence of resource distribution. However, different members may summarize their information with a great variation in quality, as a function of motivation, involvement in the task, personal abilities, familiarity with the materials, and so on. Thus, the present experiment aims at contributing to the literature on peer learning by studying the differential impact of a partner's competence in learning settings where resources are distributed either in an independent or in a positively interdependent way.

Resource interdependence during dyadic cooperative work at university

Previous results show that positive resource interdependence – that is, working on complementary information – improves students' learning when they work cooperatively on texts (Lambiotte et al., 1987, 1988) compared to resource independence – that is, working on identical information. Moreover, Johnson, Johnson, and Stanne (1989) as well as Ortiz, Johnson, and Johnson (1996) suggest that positive resource interdependence is beneficial for learning only when associated with positive goal interdependence; that is, in cooperative settings.

More recently, Buchs and colleagues adapted these methods to show that whether one is more effective than the other is a question that has hidden the more fundamental problem of the different mechanisms involved in them (Buchs & Butera, 2001 2004; Buchs, Butera, & Mugny, 2004). Students worked in cooperative dyads on two texts. When students worked on complementary information, each student received only one text and accessed the other text through his or her partner. When they worked on identical information, students accessed the two texts before discussion. Two roles were proposed in each dyad: Summarizers had to try their best to explain information while listeners had to facilitate these explanations by asking for clarifications and by adding elements. The role alternation from one text to the other was supposed to enhance motivation (Spurlin, Dansereau, Larson, & Brooks, 1984) and individual responsibility.

Results from this line of research indicate that resource interdependence elicits two different dynamics when the two peer-learning methods are compared (see Buchs, 2008, for a review). Working on complementary information enhances both partners' involvement: The summarizers spent more time giving explanations, expressed more ideas, and offered more responses to solicited help. The listeners asked more questions. Students also reported more efforts to explain information and showed more positive reactions. Hence, positive resource interdependence when working on complementary information stimulates students' involvement and cooperation (Buchs, Butera, & Mugny, 2004). In this condition, informational dependence is strong. Indeed, listeners' learning can depend on the transmission of information and on the quality of summarizers' informational input. Results indicate that the quality of summarizers' informational input is a moderator of the positive effect of working on complementary information on listeners' learning (Buchs, Butera, & Mugny, 2004; Buchs, Pulfrey, Gabarrot, & Butera, in press).

In contrast, working on identical information enhances competition and confrontation: students displayed more negative reactions and spent more time to confront (Buchs, Butera, &

Mugny, 2004). Students also reported more social comparison activities related to competence threat. Working on identical information oriented students toward a competitive relational conflict regulation (Buchs et al., in press) preventing confrontation from being positive for learning (Buchs & Butera, 2004; Buchs, Butera, Mugny, & Darnon, 2004; Darnon, Buchs, & Butera, 2002). Moreover, a self-reported competence threat is shown to be responsible for negative effects of working on identical information (Buchs, Butera, & Mugny, 2004, study 2).

In sum, previous results indicate that when working on complementary information, informational dependence is critical and that positive student interactions are favourable for learning only when the quality of informational input is high; however, when working on identical information, competence threat is critical and can interfere with learning despite of cooperative instructions.

Resource interdependence and partner's competence

In the above research, the manipulation of resource interdependence assumes that the partner's behaviour is homogenous and depends on the specific resource interdependence condition in which the participants are embedded. However, this research has also shown that there are variations in the perception of the partner's competence and that this perception has an impact on performance as a function of resource interdependence. In Buchs, Butera, and Mugny (2004, study 2), students evaluated their partner's competence by means of a questionnaire. Results indicate that the model including the interaction between the perceived partner's competence and resource interdependence with the two independent variables explains 30% of the variance in students' learning. When working on complementary information, the more they perceive their partner as competent, the better they perform, whereas the relation is negative when they work on identical information.

Therefore, in the present research, we decided to directly manipulate the partner's competence. We proposed that when students work on complementary information, informational dependence is critical. It can be hypothesised that working with a competent partner could be beneficial for learning when working on complementary information. In contrast, we proposed that when students work on identical information, competitive social comparison and competence threat are critical. It can be hypothesised that working with a competent partner could be threatening to the student's own competence and detrimental for learning when working on identical information. In the present research, we operationalised the partner's competence through the quality of a confederate's summary (brilliant *vs.* average). We predicted an interaction effect between resource interdependence and the quality of the partner's summary: Under positive resource interdependence (complementary information), a brilliant summary would elicit higher performance than an average summary, while under resource independence (identical information), a brilliant summary would elicit a lower performance than an average summary.

Method

Participants

This experiment took place in a laboratory during a one-hour session. Thirty-seven third-year psychology students from a large French university participated for extra credit. Since psychology students are mainly women, we decided to recruit only women; therefore, the confederate was a woman. Eighteen students worked on complementary information (9 with a brilliant and 9 with an average partner), and 19 worked on identical information (10 with a brilliant and 9 with an average partner).

Procedure

Each student arrived at the laboratory at the same time as the confederate. They were requested to work together on two texts. Participants were randomly assigned to conditions in a 2 (resource interdependence: independence, positive interdependence) x 2 (confederate's quality of summary: brilliant, average) factorial design. Positive goal interdependence was kept constant in all conditions: Students were asked to work cooperatively and try their best to promote both their own learning and that of their partner. Role interdependence was also constant. Students were told that for each text, one student would be responsible for the text and play the summarizer role while the second would play the listener role. In line with scripted cooperation procedures (O'Donnell, 1999), it was explained that the summarizer role consists of explaining as clearly as possible and in a detailed way the information contained in the text. While these roles designated the students' primary task, they did not preclude interactive exchanges. They had 10 minutes to read and 8 minutes to discuss each text.

The confederate was always designated to be summarizer for the first text and the student for the second text. In fact, only the first text would be used to assess the participants' performance; indeed, our hypothesis concerns the effect of the confederate's summary on the listener. We decided to use two texts in order to follow the same procedure as in previous studies, to keep reciprocal interdependence when working on complementary information, to maintain motivation due to role alternation, and to avoid the frustration of stopping the experiment before taking responsibility for a text. After the discussion, the students answered an individual multiple-choice test on the texts studied during the session.

Materials

Students worked on two social psychology texts: one on cognitive dissonance and one on commitment. The length was quite similar – 1131 words *versus* 1147 words, respectively – and we checked that the specific content of these texts had not been addressed in any other course in the students' curriculum to ensure that the content of the texts was unfamiliar to the students. However, we remind that only the first text is used to assess performance. We checked that both texts could be read in less than 10 minutes with 6 students not enrolled in the experiment.

Independent variables

Resource interdependence. In the resource independence conditions, students worked on identical information. The student and the confederate read the two texts silently and then discussed them following the assigned roles. More specifically, they both had 10 minutes to read the text on cognitive dissonance; the confederate then played the summarizer role while the student played the listener role during the 8-minute discussion. After that, they both had 10 minutes to read the text on commitment, and the roles reversed for the 8-minute discussion, although this second text is not considered in the analyses.

In the positive resource interdependence conditions, they worked on complementary information. Students read only one text and accessed the other text via the summary presented by the confederate. More precisely, the confederate first read the text on cognitive dissonance during the 10-minute period and played the summarizer role during discussion. After that, the student read the text on commitment and played the summarizer role. The texts can be considered as complementary because students were aware they had to master the content of the two texts in order to answer the questions in the individual multiple-choice test that they knew would follow the exercise. In order to sustain a good level of attention from the listener during the reading period, this student was asked to read a newspaper article; students were informed that the purpose was to maintain their attention during the reading period and that the newspaper would not be discussed.

Quality of confederate's summary. We trained the confederate to present either a *brilliant summary* or an *average summary*. We took care that all information was presented in the summary so that the content was similar, but the way the confederate presented it varied. In the brilliant condition, the confederate elaborated a well-structured summary, with different parts and precise terms. The confederate used very clear and structured notes to explain (e.g., hierarchical parts, starting with an introduction and definitions, developing ideas logically, and ending with a conclusion). In the average condition, the confederate proposed a disorganised summary with a lot of back-and-forth because of omissions, with confused speech and approximate terms. The confederate used unstructured notes (e.g., no hierarchical parts, with numerous corrections, the definitions given at the end).

Dependent variables

Individual learning was assessed at the end of the session by a multiple-choice test (MCT) composed of 8 questions per text; however, only the questions on the first text, where the participants played the listener role, will be used for computing the dependent variable. The MCT was developed by social psychology teachers and perfectly matched the normal exam format. Moreover, it should be noted that the tests included both questions about the text content (4 questions regarding the theory and the related experiments) and comprehension questions (4 questions requesting generalization to new situations; mere memorizing was not sufficient to find the correct answer). This allowed for considering the present MCT as a measure of learning. Each question had 4 answers with only one being correct. One point was allocated for a correct answer, 0 for no answer, and -0.25 for mistakes, meant to discourage students from answering at random. These criteria were the ones used in the official evaluation carried out in the regular courses and were explained again to students before the MCT. Thus, learning scores ranged from -2 to +8.

Table 1

Student learning of the text presented by the confederate

	Identical information	Complementary information
	<i>N</i> =9	<i>N</i> =9
Average summary	<i>M</i> =3.03 <i>SD</i> =1.24	<i>M</i> =2.75 <i>SD</i> =1.38
Brilliant summary	<i>M</i> =2.15 <i>SD</i> =1.24	<i>M</i> =3.67 <i>SD</i> =1.00

Note. Performance ranges from -2 to +8.

Results

Our hypothesis predicted an interaction between resource interdependence and the quality of confederate's summary on the performance that students obtained at the MCT concerned with the text presented by the confederate. More precisely, it is proposed that in the complementary information condition, students should perform better when they work with a brilliant than with an average partner, while in identical information condition, they should perform better when they work with an average than with a brilliant partner.

A 2 (resource interdependence: independence, positive interdependence) x 2 (quality of confederate's summary: brilliant, average) ANOVA reveals that neither resource interdependence, $F(1,33)=2.37, p<.13, \eta_p^2=.07$, nor the quality of confederate's summary,

$F(1,33)<1$, yield significant main effects. In line with our hypothesis, however, the interaction is significant, $F(1,33)=4.97$, $p<.04$, $\eta_p^2=.13$. Means and standard deviations are presented in Table 1. As predicted, in complementary information condition students perform better when working with a brilliant partner than with an average partner, while in identical information condition, the reverse is true: They perform better when working with an average partner.

Moreover, an additional result is worth being noted as a cue of competence threat when working on identical information: When students work with a brilliant partner, listeners learn less when they work on identical information ($M=2.15$ with direct access to the text) than when they work on complementary information ($M=3.67$, without direct access to the text), $F(1,33)=7.29$, $p<.01$, $\eta_p^2=.18$. When working with an average partner, students learn the same whether they work on complementary ($M=2.75$) or identical information ($M=3.03$), $p>.63$.

Discussion

This study investigates whether a partner's competence moderates the effects of resource interdependence during cooperative dyadic work on texts at a university. Although the confederate's informational input was correct in both conditions, the formal quality of the summary varied. Results indicate that a partner's competence does moderate the effect of resource interdependence. A partner's competence is beneficial for listeners' learning when they work on complementary information: In this condition, the brilliant partner induces better learning than the average partner. This positive effect of a partner's competence on listeners' learning underlines that a high level of argumentation can deepen understanding and learning. Indeed, we expected this effect, especially when students work on complementary information because of the informational dependence typical of this condition.

On the contrary and as predicted, a partner's competence has a negative effect on listeners' learning when they work on identical information: In this condition, the brilliant partner induces poorer learning than the average partner. We interpret this negative effect of summarizers' competence on listeners' learning in identical information in terms of competence threat for three reasons. First, previous research proposed that task structure affects the likelihood of students' social comparison (Marshall & Weinstein, 1984; Rosenholtz & Wilson, 1980). More precisely, working on identical information reinforces social comparison of competence and competence threat that mediates the negative effect of working with identical information on learning (Buchs, Butera, & Mugny, 2004, study 2). Therefore, the more competent the partner, the more this comparison can interfere with students' learning. Second, the present results indicate that if interacting with a brilliant partner, listeners learn less when they work on identical than on complementary information. This means that students who work with a brilliant partner perform more poorly when they both read the text *and* listen to the partner (identical information) than when they only listen to their partner without reading by themselves (complementary information). This result is a paradox from an informational point of view, which pleads for our interpretation in terms of competence threat: A partner's competence is threatening and detrimental to students' learning when working on identical information. Thirdly, an alternative hypothesis in terms of lack of attention is not supported by data. If listeners paid less attention when working on identical information because they already knew the information, it could be expected there would be no relation between summarizers' competence and listeners' learning. Whatever the partner said, it should not affect the listeners' learning. However, in our study, the effect is actually a negative one, which underlines that a partner's competence interferes with students' learning.

Two limitations can be noted: the small number of participants in each condition and the lack of measured mediators in this study. However, in a recent study, we manipulated the quality of partner's informational input indirectly by the possibility to take notes or not with more participants and we assessed potential mediators (Buchs et al., in press). This study supports the present results: Note-taking proved to moderate the effect of resource interdependence (as

partner's competence in the present study), and this moderation was mediated by competitive relational conflict regulation (that is confrontation and competence threat).

Two important implications can be drawn. First, when students work on complementary information, it is important to take care of the quality of informational input; indeed, we have seen that under positive resource interdependence, a more competent partner can promote learning. This result speaks for the promotion of certain methods used in the peer-learning literature, such as (a) allowing groups of summarizers to work together in advance to clarify and prepare the explanation of information (see, for example, the jigsaw method, Aronson, Blaney, Stephan, Sikes, & Snapp, 1978; Clarke, 1999), (b) ensuring that the difficulty of the texts is adapted to the students (Buchs, Butera, & Mugny, 2004), and (c) proposing that students take notes and use their notes and the text to explain information (Buchs et al., in press). Second, it is important to reduce competence threat when students work on identical information to allow students to benefit from their partner's competence; indeed, we have seen that under resource independence, a more competent partner can hinder learning.

How can we reduce the threat associated with a partner's competence? One direction can be found in the achievement goal literature (Elliott & Dweck, 1988). Recent research indicate that achievement goals can moderate learning in settings involving social interactions (Darnon, Butera, & Harackiewicz, 2007; Darnon, Doll, & Butera, 2007; Darnon, Harackiewicz, Butera, Mugny, & Quiazade, 2007; Gabriele, 2007). Results by Gabriele and Montecinos (2001) are particularly relevant. In our study, students working with a brilliant partner perform better when they work on complementary information (documented to favour cooperation and involvement in information transmission) than on identical information (documented to reinforce competitive social comparison and competence threat). In Gabriele and Montecinos study, a low-achieving partner working with a skilled partner performs better under learning goal instructions (documented to favour motivation to improve cognitive understanding) than performance goal instructions (documented to favour motivation to demonstrate abilities as compared to others). Moreover, the low achievers' perception of the more skilled partner's relative competence is negatively linked with the low-achiever's learning, but only under performance goal instructions. In contrast, high-level participation of the more skilled partner favours the low-achiever's learning under learning goal instructions, but not under performance goal instructions. Taken together, these results suggest that promoting learning or mastery goals in the classroom is one way to reduce competence threat and allow a student to benefit from their partner's competence when they work on identical information.

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Des études antérieures avec des étudiants universitaires ont montré que l'interdépendance des ressources lors d'un travail coopératif en duos sur des textes entraîne deux dynamiques différentes en ce qui concerne les interactions et l'apprentissage. Travailler sur des informations complémentaires favorise des interactions positives; cependant une bonne qualité de la transmission des informations est nécessaire pour favoriser l'apprentissage des étudiants. Travailler sur des informations identiques stimule des confrontations de point de vue tout en introduisant une comparaison sociale menaçante des compétences, qui peut réduire l'apprentissage. Le but de l'étude est de tester le rôle modérateur de la compétence du partenaire dans les deux situations d'apprentissage en manipulant la compétence du partenaire grâce à un compère. Les résultats indiquent que la compétence du partenaire est bénéfique lorsque les étudiants travaillent sur des informations complémentaires alors qu'elle est néfaste lorsqu'ils travaillent sur des informations identiques.

Key words: Cooperative learning, Competence threat, Informational dependence, Partner's competence, Resource interdependence.

Received: March 2008

Revision received: September 2008

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Current theme of research:

Peer-learning. Sociocognitive conflict. Social interactions.

Most relevant publications in the field of Psychology of Education:

- Buchs, C. (2008). La distribution des informations dans les dispositifs d'apprentissage entre pairs. In Y. Rouiller & K. Lehraus (Eds.), *Vers des apprentissages en coopération: Rencontres et perspectives* (pp. 57-80). Bruxelles: Peter Lang.
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Current theme of research:

Cooperation and competition. Conflict. Motivation. Norms.

Most relevant publications in the field of Psychology of Education:

- Darnon, C., Butera, F., & Harackiewicz, J. (2007). Achievement goals in social interactions: Learning within mastery vs. performance goal. *Motivation and Emotion, 31*, 61-70.
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