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Comparison of Four Reciprocal Peer Tutoring Settings for Acquiring Basic Life Support with Task Cards

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Introduction

Social constructivism has become a dominant theoretical framework in learning and instruction. Consequently, many educational researchers have developed and investigated instructional strategies from this perspective. Generally, those methods encourage discovery learning settings in which students work together in groups with no or minimal guidance. It has been stated that learners learn best in a non- or minimally guided setting where they have to discover and construct knowledge for themselves (Steffe & Gale, 1995; Papert, 1980). Advocates of this approach believe that instructional guidance might interfere with the natural learning processes and styles of learners and consequently negatively affect learning outcomes. Furthermore, learning is considered to be idiosyncratic and therefore a common instructional format or strategy might be ineffective (Steffe & Gale, 1995). However, an increasing amount of research evidence indicates that discovery learning settings with no or minimal guidance are inferior to guided methods of instruction in helping students learn and transfer (Aulls, 2002; Mayer, 2004; Moreno, 2004; Shulman & Keisler, 1966; Tuovinen & Sweller, 1999). In explaining this general finding, cognitive research has put forward the architecture of human cognition.

Instructional procedures with no or minimal guidance are argued to overload the working memory, as explained in information processing theories (Chandler & Sweller, 1991; Mayer, 2001). This implies that with no or minimal instructional guidance, working memory is used to search for problem solutions and is consequently less available for learning activities through interaction with the long term memory (Kirschner et al., 2006). Therefore, it has been stated that learners with limited prior knowledge in any subject matter should be provided with direct instructional guidance on concepts and procedures and should not be left to discover these procedures by themselves (Mayer, 2004; Shulman & Keisler, 1966). Previously conducted controlled experiments indicate that when dealing with new information, learners should be told what to do and how to do it (Kirschner et al., 2006). Besides the research findings concerning instructional guidance in the cognitive domain, similar research findings can be found within the context of peer assisted learning, such as reciprocal peer tutoring. In physical education, reciprocal peer tutoring is a commonly implemented instructional strategy. In this format, students are paired and exchange roles of doer and helper (Mosston & Ashworth, 1994). While one student practices (doer), the other student observes (helper) and provides feedback or instruction. The feedback provided by the helper is based on instruction given by the teacher or instructional tools such as task cards. A substantial body of literature has documented the effectiveness of pairing students to teach and assess each other in both regular (Cohen, Kulik, & Kulik, 1982; Walberg, 1990) and special educational settings (Greenwood, Delquadri, & Hall, 1989; Greenwood, Maheady, &Carta, 1991). Moreover, it has been shown that academic gains can occur for both doers and helpers (Simmons, Fuchs, Fuchs, Mathes, & Simmons, 1997). According to Topping (2005), the cognitive exercise and benefit for the helper lies in the monitoring of the doer’s performance, detecting, diagnosing, correcting and managing misconceptions and errors. However, positive peer tutoring effects on learning outcomes are not accidental. Merely placing students in pairs is believed to be insufficient to ensure that learning will occur. Only when structure is implemented so that students understand how they should work together, cooperation and learning become maximised (Dyson, 2001; Johnson & Johnson, 1994). It has been argued that spontaneous tutoring behaviour tends to be primitive in unstructured peer tutoring settings (Person & Graesser, 2000). Moreover, Cohen (1994) reported that children in structured groups provided more solicited and unsolicited explanations than children in unstructured groups. It is believed that the frequencies of these types of interactions positively affect the learning that occurs. Despite these positive research findings, it should be acknowledged that a lot of research into peer tutoring within physical education is fragmentary, generally lacking conformity concerning design, procedures and the implementation of experimental conditions. This complicates the attempt to discriminate mediating variables responsible for better learning outcomes in different target groups. Furthermore, a lot of peer tutoring research in physical education seems to be comparative, comparing a control group or a baseline of regular instruction to one or more tutoring conditions (for review, see Ward & Lee, 2005). For example, a number of studies compared the effects of Mosston’s (1981) reciprocal teaching style with his command style of teaching. However, the present study focuses on the reciprocal peer tutoring setting itself. Four reciprocal peer tutoring settings are implemented to learn Basic Life Support (BLS) with task cards as instructional tools. Settings differed in the amount and quality of instructional guidance. Because task cards were the only source of information for learning BLS, it is worthwhile to take a closer look on how people learn from such instructional tools.

Instructional tools like task cards are useful to assist social constructivist learning settings like reciprocal peer tutoring. This is mainly because in contrary to more behavioural teacher centred settings, reciprocal learning settings do not merely rely on direct teacher information. Task cards combine a picture of the skill with specific instruction on how to perform the skill. Given the definition of multimedia by Mayer (2001), task cards are considered to be multimedia instructional tools. Research on learning from multiple external representations has concluded that text information is remembered better when it is illustrated with appropriate pictures than when there are no illustrations. This multimedia principle is explained in Mayer’s (2001) cognitive theory of multimedia learning, based on cognitive research on how the
human mind works. According to this theory, learners actively process information from multimedia messages like task cards by selecting relevant words and pictures, organising this information into a coherent verbal and pictorial representation and finally integrating these representations with prior knowledge. Despite promising applications of this process in cognitive skills, some questions arise concerning its generalisation into other domains. What does the process of selecting, organising and integrating means for the acquisition of, for example, a psychomotor skill like BLS in a reciprocal peer tutoring setting? Furthermore, could these processes be affected by instructional guidance in a reciprocal peer tutoring setting? In this study, only the selection of relevant information in a reciprocal peer tutoring setting using task cards is addressed.

In this article, four reciprocal peer tutoring settings were implemented to learn a BLS sequence with task cards as instructional tools. Experimental settings differed in the amount of explicit instructional guidance. BLS consists of a series of actions to be performed in a specific order, aimed at saving a person’s life. Based on the skills scheme from Romiszowski (1999), BLS can be classified as a reproductive skill because of the application of a standard procedure (algorithm). Concerning the nature of the skill, BLS forms a combination of motor and cognitive skills. This study explored whether the separate and combined implementation of two instructional guidance variables enhances learning outcomes in a reciprocal peer tutoring setting using task cards for acquiring a complex psychomotor skill like BLS. Also, instructional guidance is linked to the selection of relevant information, the first step for active processing when learning from multimedia such as task cards.

Methods

Sample and student grouping

The sample was made up of a total of 72 first year Kinesiology students (aged 17-19 years), 21 men and 51 women from the Katholieke Universiteit in Leuven, Belgium. Students chose a partner themselves and student pairs were randomly divided into four groups of 18 students: the role switching group, the task definition group, the combined group (all three consisting of 5 men and 13 women) and a control group (6 men and 12 women).

Research procedure and experimental groups

Baseline BLS performance was measured individually. Therefore, students received standardised instructions and the following scenario on a laptop computer: “You are asked to help a man who has just collapsed. The manikin in this room represents that man. You have two minutes to help the man to the best of your abilities. I will answer questions concerning the victim’s condition, but I will not tell you what to do.” A mobile phone was present next to the victim. Students’ actions were evaluated as baseline BLS performance. At intervention student pairs were given 20 minutes to learn a BLS sequence by means of task cards. Task cards were continuously available during intervention. Student pairs were randomly assigned to one of four experimental settings and received standardised instruction on a laptop computer according to their experimental group. In the role switching group students were asked to work in a doer-helper relationship. The function of the doer and helper was not defined. Every five minutes students had to switch roles as prompted by the researcher. In the task definition group, students were also asked to work in a doer-helper relationship. The task of the helper was clearly defined as following the instructions given by the helper. No specific instruction concerning the switching of roles was given. In the combined group students worked in a defined doer-helper relationship and they switched roles every five minutes. In the control group students received no instructional guidance on how to structure the learning setting. After 20 minutes intervention time BLS performance was individually assessed. Retention testing was conducted two weeks following intervention. In the meanwhile, participants were asked not to engage in BLS activities.

Basic Life Support task cards

Eleven task cards were developed to learn BLS. Their content was developed according to the European Resuscitation Council 2005 guidelines and comprised the instruction of nine BLS items (Handley et al., 2005), namely safe approach, check responsiveness by shaking gently and shouting loudly, shout for help, open airway, perform thirty chest compressions, perform two ventilations and continue the 30 compressions-2 ventilations sequence. Instructions for performing chest compressions and ventilations were provided on two task cards due to the complexity of these skills. All task cards had an A4 format and combined a picture of the BLS skill with instruction on how to perform the skill. To foster constructivist learning, task card design was based on multimedia learning research (Mayer, 2001; Mayer & Moreno, 2003).

Assessment of Basic Life Support performance

All BLS assessments were individually completed on a Laerdal AED ResusciAnne manikin connected to a laptop computer running specific software (Laerdal PC-Skill Reporting system version 2.0, Laerdal Medical, Vilvoorde, Belgium). This software recorded the following cardiopulmonary resuscitation (CPR) variables: total number of compressions, average compression depth, average compression frequency, hand position, total number of ventilations, average ventilation volume and ventilation-compression ratio. In addition, qualitative assessments were made by two blinded researchers evaluating the following variables from video and audio tape recordings at baseline, intervention and retention: safe approach, check responsiveness by shaking gently and shouting loudly, shout for help, open airway,
check for breathing, call for help or 112, continue 30-2 sequence, performed all BLS skills and performed all BLS skills in correct order. Some of the variables evaluated by blinded researchers were dichotomous (performed – not performed), others had multiple responses. Intra- and inter-observer reliability was measured using Cohen’s Kappa. Intra-observer reliability was 0.98 for researcher A and 0.96 for researcher B. Inter-observer reliability was 0.91. To calculate the overall BLS performance, qualitative and quantitative data were entered in a scoring system based on the Cardiff Test (Whitfield, Newcomb & Woollard, 2003). Total BLS scores could range between 19 and 73 points. Exact values of all individual variables in the four groups were also compared.

**Data analysis**

For BLS, dichotomous variables (performed – not performed) were analysed using Pearson’s chi squared analysis. Variables with multiple responses, total BLS scores and continuous cardiopulmonary variables from the manikin were analysed using one way analysis of variance (ANOVA).

**Results**

**Baseline outcomes**

Baseline testing indicated no significant differences between the four groups for mean CPR variables, individual BLS items and total BLS score. The average percentage of the total BLS score between groups was 15%.

**Intervention outcomes**

Intervention testing indicated a significant difference between groups for the percentage of correct chest compressions (p = 0.039, F = 2.94). Post hoc Scheffé analysis indicated no significant differences between groups. The average percentage of the total BLS score between groups was 79%.

**Retention outcomes**

At retention, no significant differences were found for mean CPR variables and total BLS score. The average percentage of the total BLS score between groups was 74%. The average percentage of the total BLS score between groups was 15%. However, significantly more students from the combined group performed all BLS skills (p = 0.035).

**Discussion**

The immediate impact of instructional variables like role switching and task definition in a reciprocal peer tutoring setting using task cards on individual student performance seems to be limited. At intervention, only a significant difference between groups was found for the percentage of correct chest compressions. At retention however, students from the combined group remembered and consequently performed significantly more BLS skills than their counterparts in the control group. This finding indicates a significant loss of learning in the group receiving the least guidance compared to the group receiving the most guidance. Similar findings were found by Clark (1989). After reviewing 70 studies he found that students with less aptitude who were assigned to unguided, weaker instructional treatments received significantly lower scores on post-tests than on pre-test measures. It can be concluded from the present study that when working in pairs using task cards, implementing instructional guidance concerning role switching and task definition is beneficial for skill retention. Moreno (2004) argues that a growing body of research shows that students learn more effectively from strongly guided learning than discovery.

According to Mayer (2004), a basic premise in constructivist learning is that meaningful learning occurs when learners select relevant incoming information, organise it into a coherent structure and integrate it with other organised knowledge. It could be argued that selecting relevant information –the first step required for active cognitive processing– is enhanced through direct peer instruction. By receiving face-to-face instruction from a peer as in the task definition and combined group, the process of selecting relevant information might be enhanced compared to reading a task card for oneself. It is possible that learners’ working memory faces a higher cognitive load when selecting relevant information by reading the task card oneself compared to receiving direct instruction from a peer. However, only a significant difference in skill retention was demonstrated between the control group and the combined group, whereas no difference was found between the control group and the task definition group. It seems that when the role switching is not implemented, the impact of task definition on learning outcomes is also limited. In other words, it could be argued that when students are free to switch roles, skill retention is not fostered. Maybe students in the present study were possibly not capable to divide the learning time equally or adequately. According to King and his colleagues (1998), learning gains in reciprocal learning could be explained in terms of the role switching that engages students in greater questioning, explaining, monitoring and regulation of learning (King, Staffieri & Adelgais, 1998).

This study has its restrictions. Firstly, learning time for acquiring BLS in each experimental setting was 20 minutes. Also, retention testing was conducted two weeks following intervention. It could be argued that more or less significant differences in student performance between experimental settings would arise when time related factors would be increased or decreased. Secondly, the sample group in this study consisted of university students in Kinesiology. It could be suggested that these students are more acquainted with learning psychomotor tasks such as BLS and consequently achieve higher learning outcomes. In other words, it could be questioned whether the impact of instructional guidance on
student performance in this target group is more restricted in comparison to other groups. Further research is needed to investigate the generalisability of the findings of this study.

Conclusion

In this study, the issue of instructional guidance is addressed within the context of reciprocal peer tutoring using task cards for acquiring BLS, a complex psychomotor skill consisting of nine items to be performed in a specific order. Four experimental settings were compared, differing in explicit instructional guidance. From the present study, with its limitations as discussed above, it can be concluded that instructional guidance comprising role switching and task definition in reciprocal peer tutoring settings using task cards enhances skill retention.

References


