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The effect of cooperative learning on the thinking skills development of Foundation Phase learners

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Abstract
We report on the findings obtained from a mixed-method study conducted in South Africa with a conveniently and purposively selected sample of 60 Grade 3 learners and their two teachers. The aim was to establish the thinking skills development of the learners and to determine the merits of a curriculum-based cooperative teaching and learning intervention programme for enhancing and/or improving the thinking skills of the learners. Quantitative data were collected by means of pre- and post-testing, as well as by means of structured observations during the fifteen-week implementation period of the intervention. Qualitative data were collected by means of semi-structured interviews with the teachers and focus group interviews with the learners. The research findings have significant implications for enhancing teaching practice in the Foundation Phase to improve thinking skills by means of a cooperative teaching and learning approach.

Keywords/phrases: cooperative learning, cognitive development, Foundation Phase learner

Introduction
The previous National Curriculum Statement of South Africa (NCS) on which the present research focused, and the new Curriculum and Assessment Policy (CAPS) that guides teaching and learning in the Foundation Phase (Grades 1–3) from 2012, are both characterised by the strong cognitive focus they place on teaching. Both curriculum documents envisage producing learners who will be able to identify and solve problems and make decisions, using critical and creative thinking (Department of Basic Education 2011; 1997). In support of this ideal, the ‘Norms and Standards’ for Teachers (South Africa 1996) requires that teachers create learning environments for the development of thinking skills such as analysis, evaluation, reflection, problem-solving, interpretation as well as critical and creative thinking.

Troutman and Lichtenberg (2003) assert that because of a crowded curriculum, the development of thinking skills and problem-solving strategies has been neglected. It is, however, of vital importance that the development of thinking skills should start receiving greater attention in the Foundation Phase. In support of this argument, Bloom (cited in Papalia, Wendkos Olds and Duskin Feldman 2008; Patterson 2008) state that by the age of eight years learners have already developed 80% of their innate ability to learn, and are thus receptive towards problem-solving activities through critical and creative thinking.

The literature reveals that cooperative learning could be regarded as an effective teaching strategy to enhance cognitive development (Bjorklund 2005; Eggen and Kauchak 2004; Gawe 2007; Gunter,
Estes and Schwab 2003; Kruger and Adams 2002; McGonigal 2005; Ormrod 1995; Schraw and Olafson 2003; Slavin 1987; Woolfolk 2004; Zuckerman 2003). In addition, literature also supports the use of cooperative learning in the Foundation Phase classroom to develop thinking skills (Bjorklund 2005; Eggen and Kauchak 2004; Ormrod 2008; Webb, Favriar, Sydney and Mastergeorge 2001; Woolfolk 2004). However, there is very little research documenting the effects of cooperative learning on the cognitive development of Foundation Phase learners. National and international studies done in this field by De Korte (1976), McFarlane (2006) and Vorster (2001) revealed that the development of thinking skills is neglected in pre-primary education, internationally and in South Africa. Against the background of the aforementioned neglect, it could be assumed that learners entering the Foundation Phase would possibly lack or not have well developed thinking skills. The research studies of De Korte (1976) and Vorster (2001), in particular, advocate an early start with cognitive development in South Africa, and argue that most learners’ parents do not have the necessary skills to assist the cognitive development of their children (De Korte, 1976; Vorster, 2001). Linked to the aforementioned finding, the classroom appears to be the most obvious place to deal with the development of thinking skills.

A study conducted by Igel (2010), which involved a meta-analysis of quantitative studies conducted during 1998–2009 on cooperative learning, revealed that it is an effective instructional tool particularly for older learners in terms of academic achievement, learning behaviour, interpersonal relationships and psychological well-being, but does not report any advantages for cognitive development. Owing to the neglect of the development of thinking skills in pre-primary education in South Africa and the lack of research documenting the effect of cooperative learning on cognitive development, the current study was developed to explore the effect of cooperative learning as a teaching strategy that promotes social learning on the development of thinking skills of Foundation Phase learners.

Our research, which focused on improving the thinking skills of Foundation Phase learners, is grounded in socio-cultural theory (Gauvain 2001; Rogoff 1990; Rogoff 2003), transformative learning theory (Mezirow 1997) as well as cognitive modifiability theory (Feuerstein Feuerstein and Falik 2010; Feuerstein, Feuerstein, Falik and Rand 2002). In contrast to Piagetian, information processing and core knowledge theories on cognitive development that see the child as an individual learner (Patterson 2008), socio-cultural theory emphasizes the importance of socio-cultural factors in human development. Socio-cultural theory sees children linked with people around them through a series of social interactions and learning experiences, which facilitate cognitive growth (Gauvain 2001; Rogoff 1990; 2003). Linked to socio cultural theory, transformative learning theory advocates that dynamic relationships between teachers and learners during learning promote development and growth (Mezirow 1997). Transformative learning theory encourages teachers to create teaching and learning environments that invite intellectual openness (McGonigal 2005) and promote the sharing of ideas and opinions (Gawe 2007).

In support of the theory on cognitive modifiability, we argue that learners could acquire additional cognitive abilities not previously present or accessible even in the presence of barriers to learning (Feuerstein et al. 2010; 2002). According to Feuerstein et al. (2010), cognitive modifiability is achieved through Mediated Learning Experience (MLE) that does not only transmit knowledge and skills to learners, but also ways of reflecting on information, and ways to look for connections and associations between information. Mediated Learning Experience (MLE) refers to an interactional process in which the mediator (competent, skilled adult, educator, facilitator or even a peer) intervenes between the learner and a set of stimuli in order to unlock meaning to the learner and model the application of cognitive skills (Feuerstein et al. 2010). The absence of MLE can lead to impaired cognitive functioning that manifests in a lack of focus and clarity, impulsivity, and the ineffective application of thinking skills (Feuerstein et al. 2010) during learning.
Cooperative learning and the development of thinking skills

Lerner and Kline (2006), Papalia et al. (2008), Parke and Gauvain (2008) and Patterson (2008) are of the opinion that steady progress in the development of thinking skills takes place between the ages of four and eight. The progress is facilitated by exposure to more experiences, which provide opportunities for enhancing cognitive abilities. Learners make progress in the development of abilities to control and focus their attention, to obtain, manipulate and store information and to plan and monitor their own behaviour. According to Papalia et al. (2008) all of the aforementioned developments are central to executive functions, which involve the conscious control of thoughts, emotions and actions to achieve learning goals and to solve problems.

In conceptualizing the thinking skills development of Foundation Phase learners, we considered the three dimensions of executive functions, namely working memory, inhibitory control and cognitive flexibility (Best and Miller, 2010; Diamond, 2006; Harvard University, 2011; Miyake, 2009; Miyake, Friedman, Emerson, Witzki, Howarter and Wager, 2000) as important for delineating the focus of the research. The term executive functions serves the purpose of an umbrella term that encapsulates a number of abilities that enable a person to behave differently, to apply skills and strategies think differently and to reflect on behaviour and thinking (Diamond, 2006). As children start to move through their school years, especially between the ages 5 and 7, the development of executive functions is accompanied by the development of the brain, in particular the prefrontal cortex, the region that enables planning, judgement and decision making (Lamm, Zalazo and Lewis, 2006). The development that takes place between the ages 5 and 7 may make possible improved meta-memory (knowledge about the process of memory) (Flavell, Miller and Miller, 2002).

During the school going years, the capacity of the working memory gradually increases to hold and manipulate information to enable complex thinking and goal-directed planning (Diamond, 2006; Luna, Garver, Urban, Lazar and Sweeney, 2004). The capacity to apply inhibitory control during learning also increases as learners move through their school years. Learners start demonstrating an increased capacity to apply the skill to master and filter thoughts, resist temptations and distractions, avoid impulsive behaviour and pay selective and focused attention (Diamond, 2006; Harvard University, 2011). It is clear that the executive functions for inhibitory control refer to good dispositions constituting an important part of good thinking (Diamond, 2006; Ritchhart & Perkins, 2008), for which, according to Feuerstein et al. (2010), MLE is required. The third dimension of executive functions that gradually develop throughout the school going years, namely cognitive flexibility, refers to the ability to adjust to changed task demands, priorities and perspectives that require the application of different cognitive and meta-cognitive skills and strategies (Diamond, 2006).

In summary, executive functions involve the application of complicated and less complicated cognitive and meta-cognitive skills and strategies that are essential for learning and social interaction (Diamond 2006; Harvard University 2011). Cognitive skills which can be of lower-order or higher-order, refer to skills for recalling information (lower-order) and higher-order skills refer to skills to synthesize, analyse and evaluate information (Fisher 2005; Thornton 2002). Cognitive skills also involve the application of creative and critical thinking skills as well as micro-thinking skills that relate to inquiry processes, reasoning processes, information gathering, processing and organizing (Fisher 2005; 2000). Cognitive strategies comprise complex actions, which require the execution of a number of steps, such as problem-solving, decision-making and conceptualizing (Moseley, Baumfield, Elliott, Gregson, Higgins, Miller and Newton 2005) that learners need to apply in order to complete certain learning tasks. Finally, meta-cognitive skills help learners to plan, control and evaluate their knowledge and thinking (Fisher 2005).

Due to the learners’ increase in ability to apply the executive functions highlighted above, Davy (2006), Papalia et al. (2008), Patterson (2008) and Pick (2003) are of the opinion that Foundation Phase learners
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(Grade 1–3) can execute learning on a higher level. They become more able to predict distance and the time that it will take to complete a task, determine cause and effect and sort/categorize objects according to shape colour or size. In addition, they become more capable in determining relationships between objects, make conclusions and reason deductively and inductively. Furthermore, the ability to see that two objects, which have the same characteristics, stay the same even when perceptual orientation takes place, if nothing is added or removed from one of the objects, increases. Finally, they are able to solve problems doing basic manipulations such as addition and subtraction. It is, however, important to keep in mind that these learners are not able to think hypothetically yet, and are still concrete bound when expected to reason logically.

Killen (in Joubert, Bester and Meier 2008) argues that learners in the Foundation Phase should acquire the following thinking skills, namely, to remember (to recall knowledge from long-term memory), to understand (to obtain understanding from information and concepts), to apply (to follow the best method or technique in a given situation), to analyse (to break down the information into constituent parts and to see the correlation between them) to evaluate (to make value judgements according to certain criteria and standards) and to create (to combine elements to form a meaningful whole). This conceptualization augured well with the skills addressed by the data collection instrument (Paper and Pencil Games Group Test), which we used to determine the extent to which the thinking skills of the learners who took part in the research were developed. The mentioned thinking skills also support the thinking skills that need to be developed in the Foundation Phase as indicated in the ‘National Curriculum Statement’ and the new ‘Curriculum and Assessment Policy’ (Department of Education 2002; Department of Basic Education 2011).

The thinking skills that Foundation Phase learners should acquire, according to Killen (in Joubert et al. 2008), clearly support the development of executive functions for increased memory control (remember, understand) and cognitive flexibility (apply, analyse, evaluate, create). In addition, the authors argue that in order for the executive functions related to memory control and cognitive flexibility to be executed effectively, well developed dispositions are required to enable learners to avoid impulsive working ways when involved in tasks that require cognitive involvement, such as recalling information and obtaining and applying information. In the context of the study, the intervention purposefully focused on the development of cognitive and meta-cognitive skills and strategies related to the executive functions for memory control and cognitive flexibility. Linked to the aforementioned, dispositions such as systematic working ways, avoiding impulsive actions, focused attention and reflecting on learning, were promoted during the modelling of strategies to learners for approaching the tasks they had to complete during the intervention.

In order to develop executive functions, environments characterized by adult-learner relationships where learning experiences are scaffolded are required. Learners need to practise emerging skills until they ultimately perform the skills on their own (Harvard University 2011; Swartz and Perkins 1990). It is clear from the aforementioned that the use of cooperative learning as a teaching strategy emphasizing social interactions with others during learning could be regarded as an applicable strategy to promote the development of learners’ executive functions. In this regard, Ritchhart and Perkins (2008:57, 58) also speak of ‘visible thinking’. The notion of ‘visible thinking’ supports a socio-cultural approach to the development of thinking skills as, according to Ritchhart and Perkins (2008:57, 58), thinking should not be an individual endeavour, but a social endeavour that involves sharing and building on the knowledge of one another. In support of Ritchhart and Perkins (2008), Gauvain (2001), Gilbert (1997), Rogoff (1990) and Rogoff (2003) we are also of the opinion that thinking always originates within a social and cultural context, with the main aim to make a contribution to a better community (Dewey cited in Wegerif 2002; Fraser 2006; Webb et al. 2001). According to Feaster (1995), teachers use cooperative learning as a means to involve learners in their own learning and as a method to enhance social skills, which
The effect of cooperative learning on the thinking skills development of Foundation Phase learners

is important for interaction between learners themselves, as well as between learners and the teacher during group interaction. The social skills acquired during cooperative learning are, however, skills that are also important for the world outside the classroom. Dhand (1991:31) says cooperative learning ‘could pave the way for expanded cooperation in global, economic, social, political, ecological and humanitarian issues. Indeed, it may be added that cooperative learning has the potential to transform not only our schools and communities, but ultimately our spaceship earth.’

Apart from the social advantages, the cognitive advantages of using cooperative learning are impressive. Cooperative learning promotes creative as well as critical thinking. Working together in a group may lead to new questions and situations, which force the learners to think critically and creatively how to solve the problem. Cognitive conflict and development benefit through exchanging ideas and comparing, motivating and justifying different opinions during cooperative learning activities (Adams and Hamm 1994; Gawe 2007; Johnson and Johnson 1994; Johnson, Johnson and Stanne 2000; Schniedewind and Davidson 1987).

Based on the advantages cited above, we concluded that cooperative learning could be regarded as an effective teaching strategy for enhancing the thinking skills of the learners who took part in the study.

**Method**

As this study focused on solving a problem, namely to improve the apparent neglect of developing thinking skills among Foundation Phase learners, it was positioned within a pragmatic framework that calls for the use of mixed-method research (Creswell 2009). A sequential explanatory mixed-method research design, which comprised the use of quantitative (Paper and Pencil Games Group Test and observations) and qualitative (semi-structured interviews and focus group interviews) methods of data collection, were employed in this research.

**Research procedure**

For this study we used a pre-experimental pre-test/post-test design (Leedy and Ormrod 2005) with two experimental groups, experimental group A and experimental group B. Experimental group A and experimental group B were two intact Grade 3 classes that could not be divided randomly because the class divisions were done by the school (The Cognitive Aptitude Assessment Software 2004–2006). Experimental group A and experimental group B were exposed to a cooperative teaching and learning intervention programme on a rotational basis for fifteen weeks.

Table 1 highlights the order in which the research process was conducted with the two experimental groups.

<table>
<thead>
<tr>
<th>Experimental group A</th>
<th>Experimental group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test 1</td>
<td>Pre-test 1</td>
</tr>
<tr>
<td>Intervention programme</td>
<td>Normal class teaching</td>
</tr>
<tr>
<td>Post-test 1</td>
<td>Pre-test 2</td>
</tr>
<tr>
<td>Normal class teaching</td>
<td>Intervention programme</td>
</tr>
<tr>
<td>Post-post-test 1 (Retention test)</td>
<td>Post-test</td>
</tr>
</tbody>
</table>
The learners in experimental group A and experimental group B both wrote pre-test 1 to determine the extent to which their thinking skills were developed. Thereafter, experimental group A was subjected to the cooperative teaching and learning intervention programme for a period of fifteen weeks, while experimental group B received normal class teaching over the fifteen weeks. Experimental group A then wrote post-test 1 to determine the influence of the cooperative teaching and learning intervention programme on the development of their thinking skills. Experimental group B wrote pre-test 2 as they had not yet been exposed to the cooperative teaching and learning intervention programme for which the post-test was applicable. Experimental group A then continued with normal class teaching and experimental group B was exposed to the cooperative teaching and learning intervention programme for the fifteen-week period. Thereafter experimental group A wrote post-post-test 1, which served the purpose of a retention test to determine whether any of the thinking skills that might have improved or developed during the cooperative teaching and learning intervention programme had been retained. Experimental group B wrote the post-test to determine the influence of the cooperative teaching and learning intervention programme on the development of their thinking skills.

For the qualitative study, a phenomenological research strategy was chosen. We wanted to understand the participants’ perceptions and perspectives of the research situation. Because a phenomenological study depends exclusively on interviews, we used semi-structured interviews with the teachers and focus group interviews with the learners (Leedy and Ormrod 2005; McMillan and Schumacher 2006).

**Variables**

As we wanted to determine the influence of cooperative learning on the thinking skills development of Foundation Phase learners, the dependent variable and independent variable on which the study focused were the development of thinking skills and the cooperative teaching and learning intervention programme, respectively. Although we only controlled one independent variable in the study, we are aware of the fact that other variables such as motivation, gender, culture, language ability, home and environment could have had an influence on the results. Bearing this in mind, we cautiously formulated the findings that emanated from the study.

**Hypotheses**

As the study aimed to determine the influence of one variable on another, a number of tentative hypotheses guided the execution of the study.

The following tentative null hypothesis was formulated for the study.

\[ H_0 = \text{A cooperative teaching and learning programme will have no statistically significant influence on the development of the thinking skills of the Grade 3 learners.} \]

The following tentative directional and non-directional alternative hypotheses were formulated:

- \[ H^1_A = \text{A cooperative teaching and learning programme will have a statistically significant influence on the development of the thinking skills of the Grade 3 learners.} \]
- \[ H^2_A = \text{A cooperative teaching and learning programme will have an influence on the development of the thinking skills of Grade 3 learners.} \]
Implementation of the cooperative teaching and learning intervention programme

By meticulously following the steps for successful cooperative learning activities (Table 2) as identified by Johnson and Johnson (1984, pp. 26-40), the programme was designed in accordance with the curriculum learning outcomes for Grade 3 learners and implemented over a period of 15 weeks (Booysen and Grosser, 2008).

Table 2  Evaluation checklist for implementing cooperative learning

<table>
<thead>
<tr>
<th>Criteria for the successful implementation of cooperative learning</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning outcomes and social outcomes specified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balancing individual work and group work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criteria for assessment specified (formal and informal)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time frames set</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneous groups determined</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conducive group sizes determined (5 members per group)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roles assigned and explained to pupils (academic and social roles)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task explained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource material provided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structured tasks : Equal division of work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitor problems, assist, guide and observe the application of social skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessing task-related and social skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Report back scheduled in groups</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Report back scheduled in class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Conclusions and summaries given</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Constructive feedback given</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Time for reflection on group work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pupils allowed to assess group work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Rewards provided for group success</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The above checklist (Table 2) also served the purpose of guiding the chronological flow of each of the learning activities in the programme and guaranteed similar implementation procedures with both experimental groups. The thinking skills were introduced by means of activities that centred on the application of various cooperative teaching and learning methods such as Group Investigation, Jigsaw I, Learning Together and Team Assisted Individualisation. Before the actual implementation started, six heterogeneous cooperative learning groups of five members each were identified and the principles that guided the implementation of cooperative teaching and learning methods were introduced and explained to the learners. The social skills required for working together in each of the activities were also explained, and the learners were guided regarding effectively listening to one another, taking turns, sharing ideas and reporting their answers to one another. Each group had to decide on a name for the group and designed a banner and a slogan for the group. They also decided on basic rules that would guide their working together. This was done in order to create a feeling of belonging to the group and responsibility towards the other group members. The same learners were kept in basis groups with stable membership for the 15-week period. This was done in order to give them the opportunity to get to know one another and to sustain the working-together relationships (Booysen and Grosser 2008).
Fifteen different activities that resembled the test activities were designed and implemented over 15 weeks for approximately two hours on Fridays. The activities that focused on different cognitive demands included conducting interviews, theme discussions, problem solving, a puppet-show with the writing of an own script, reasoning, designing of a game, classification, word building and analysing information. For each of the activities work sheets with questions were designed, which learners had to complete as a group. A learning role in relation to achieving the learning outcomes for the activity was allocated to each individual learner. In addition to this, each learner also had to fulfil a specific social role during an activity, namely manager, quiet captain, motivator, scribe, presenter or timekeeper.

Wallaces’ TASC model (‘Think Actively in a Social Context’) (Wallace 2002) guided the execution of the intervention. A ‘thinking train’ was developed as a strategy for completing the activities or solving a problem. This strategy consisted of seven elements, which the learners could follow in order to enhance the development of their thinking skills during the completion of the activities. Each element of the ‘thinking train’ was discussed and demonstrated to the learners before the activity for the day started. The learners then attempted to complete the activities or solve problems in their cooperative learning groups by using the elements of the ‘thinking train’. These elements encompassed the following stages: collecting information to determine what was already known about the problem, identifying what the problem entailed, generating ideas on how to approach the problem, decision-making about the best strategies to solve the problem, implementation of strategies to solve the problem, evaluation of the effectiveness of the strategies used to solve the problem, communicating answers and reflecting on what new knowledge had been gained. An analysis of the aforementioned stages reveals that the intervention focused on increasing the learners’ abilities to apply skills and strategies to aid working memory, inhibitory control and cognitive flexibility.

A structured approach was followed during the presentation of the learning activities to get learners acquainted to working cooperatively. All lessons unfolded according to the following procedure. The learners were divided into their groups, and revision of the previous session’s work followed. In particular, learners were requested to mention problems they experienced when working together, which were addressed before the new activities commenced. The new learning activity and resource material to complete the activity were handed to group members. Each group member received a responsibility related to the task, as well as a social role to play during the completion of the task. The responsibilities of the various social roles were clarified before the activities commenced, so that learners were sure of what was expected of them. The learning task and the expected outcomes were also clarified, so that everybody knew what they were responsible for. Revision of how to use the ‘thinking train’ during the completion of a task was done at the onset of each new task, to enable learners to apply the strategy effectively while they were working. During task completion, groups were observed, monitored and informally assessed. Learners or groups, who experienced problems with the task, were assisted. Time limits were set for the completion of each task, and strictly adhered to, after which groups were given time to share information and/or to consolidate findings. Thereafter, feedback sessions were scheduled and groups shared their answers or solutions to problems with the rest of the class. In order to ensure that all groups had the correct and complete information after the completion of the cooperative learning activities, summaries were provided to all learners. All activities were concluded with an oral reflection session, where learners had to reflect on what they had learned, what they found difficult and what worked well during the completion of the activity.

**Research participants**

The research was conducted in the D8 (Sedibeng West) district of the Gauteng Department of Education in South Africa and involved a group of Grade 3 Foundation Phase learners at a primary school. This
The effect of cooperative learning on the thinking skills development of Foundation Phase learners

The school was chosen as we were familiar with the school and staff, and it was easily accessible. In addition to the convenience of the sample, it was also purposively selected. Grade 3 learners were chosen for the research as they were at the end of the Foundation Phase and, according to De Bono (1983), learners in this age group have the ability to learn thinking skills more easily and enjoy activities that involve thinking and reasoning activities. They can also be easily motivated and should have sufficient verbal ability and experience to communicate meaningfully. Furthermore, De Wit (2009) reasons that Grade 3 learners have the ability to use intrinsic thinking skills to solve problems and can concentrate for longer periods, and can therefore be involved in problem-solving activities.

The convenient and purposively selected sample consisted of the following participants: both experimental groups A and B comprised 30 Grade 3 boy and girl learners. The two teachers of both groups also agreed to take part in the study. According to the biographic information obtained by the school principal, the majority of the learners came from middle-class socio-economic backgrounds, were Afrikaans mother tongue speakers and their Language of Learning and Teaching (LOLT) was Afrikaans.

Experimental group A’s teacher was a qualified Foundation Phase teacher with many years of teaching experience in the Foundation Phase, and held the position of Head of Department for the Foundation Phase. The teacher of experimental group B was a qualified Mathematics Senior Phase teacher, who worked in the private sector for a while, until temporarily appointed in the Grade 3 post. Both teachers acknowledged during the semi-structured interviews that they were aware of cooperative learning as a teaching strategy, but never applied it due to a lack of knowledge and skills. We therefore assumed that the learners had not been exposed to cooperative learning before. In addition, the learners’ lack of knowledge regarding cooperative group work indicated to the researchers that they possibly had limited or no exposure to the use of cooperative learning during teaching before the intervention.

**Data collection: the PPG-test**

As recommended by the Human Sciences Research Council, the Paper and Pencil Games Group Test (PPG) Level 3 was regarded as a suitable test to determine the Grade 3 learners’ thinking skills development. The test required the learners *inter alia* to perceive accurately and to recognise and recall what they had perceived. They also had to think logically, understand relationships and apply generalisations to new and different contexts (Claassen, 1996).

The different test sections, the thinking skills on which they focused and the total score allocated to each section are explained in the Table 3.

<table>
<thead>
<tr>
<th>Test item</th>
<th>Thinking skills</th>
<th>Total score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 1: Figure series: non-verbal</td>
<td>Application and evaluation</td>
<td>17</td>
</tr>
<tr>
<td>Section 2: Verbal reasoning</td>
<td>Understand, application and evaluation</td>
<td>30</td>
</tr>
<tr>
<td>Section 3: Pattern completion</td>
<td>Analyze and create</td>
<td>17</td>
</tr>
<tr>
<td>Section 4: Verbal comprehension</td>
<td>Remember, understand, application and evaluation</td>
<td>20</td>
</tr>
<tr>
<td>Section 5: Number series: non-verbal</td>
<td>Analyse and create</td>
<td>15</td>
</tr>
</tbody>
</table>

Each section of the test had a different total score (Table 3). For each correct answer, the learner got a mark. A static approach to the assessment of thinking skills was used in the context of the study, as we wanted to obtain numerical data regarding the development and improvement of the learners’
thinking skills. We did not focus on the learners’ potential for developing thinking skills as advocated by a dynamic approach for assessing the development of thinking skills (Tzuriel 2008).

**Data collection: observations**

In this study, we used the observer as a participant strategy to conduct the observations (Nieuwenhuis 2007; Merriam 2009). During the intervention programme we introduced topics to the learners and modelled the application of thinking skills required for the completion of the various activities. When the learners worked in their groups to complete their activities, we acted as observers in order not to influence the outcomes. Both teachers who participated in the research were co-observers throughout the implementation of the intervention programme, without getting involved. Both teachers were requested not to apply any of the strategies used during the intervention during their daily teaching, as that could have compromised the data collection.

In this study, we made use of structured rating scale observations (Cohen, Manion and Morrison 2007; McMillan and Schumacher 2006; Nieuwenhuis 2007). Pre-determined criteria were developed in accordance with the literature, according to which we observed the development of the learners’ thinking skills during the cooperative teaching and learning intervention programme. We observed the learners in their groups during each of the intervention sessions to determine their success in applying the following cognitive skills linked to executive functioning. Our observations focused on the ability to remember instructions, the ability to understand, the ability to apply their newfound knowledge, the ability to analyse situations and make decisions, the ability to evaluate decisions, the ability to create something after thinking and reasoning with one another and the ability to plan and execute work systematically. High inference observations were made to classify the application of the thinking skills on a scale of ‘excellent’ (1), ‘good’ (2), ‘average’ (3) and ‘can improve’ (4) (Cohen et al. 2007). During each observation session of 45 minutes each over the 15 weeks, only three learner groups were observed during a session. In total, all six groups were observed seven times each. During the last week, all six groups were observed simultaneously.

**Data collection: semi-structured interviews**

Before and after completion of the cooperative teaching and learning intervention programme, a semi-structured interview was conducted with both the teachers of experimental group A and experimental group B. The interviews conducted before the programme began was aimed at determining the teachers’ perceptions of the nature of the development of the learners’ thinking skills, and the interviews conducted on completion of the programme set out to determine the influence of the programme on the learners’ application of thinking skills from the teachers’ point of view.

**Data collection: focus group interviews**

Focus group interviews were conducted with all the learners in their respective group formats on completion of the cooperative teaching and learning intervention programme to determine their perceptions of the benefits of the programme, in particular the development of thinking skills.

**Rigour**

The PPG group test is a standardised test developed by the Human Sciences Research Council in South
Africa, and norms are indicated for all learners in South Africa. The Kuder-Richardson (KR) formula is used to determine reliability. According to the KR20 formula, a coefficient of 0.9 and higher can be regarded as acceptable (Mulder 1982). All the reported test norms indicated a distribution of standard deviations, KR20 reliability coefficients and standard errors of measurement for non-verbal cognitive skills and total measurements (verbal and non-verbal cognitive skills) higher than 0.9. The PPG test is available in all eleven official languages of South Africa to facilitate a close link with the home environment, and is designed to suit the needs of all types of learners in South Africa (Claassen, 1996).

The content validity of the observations was supported by the fact that the observation criteria were distilled from the literature and reflected the thinking skills on which the study focused (Leedy and Ormrod 2005). Furthermore, all the observers used the same structured observation schedule to ensure that they all assessed the learning activities according to the same criteria. The objectivity and reliability of the observations were guaranteed by accurately and clearly describing what to observe, making use of co-observers and by observing only three groups at a time during an observation session. As the learners were very young, we acquainted ourselves with the way in which young learners are observed as set out by Daniels, Beaumont and Doolin (2008). The observers moved through the classroom among the learners during the activities without disturbing the normal teaching occurrences. As a radical change in the normal teaching occurrences may have led to unreliable results, we decided against video recording the classroom activities and only assisted when the learners asked for assistance.

The questions formulated for the semi-structured interview and the focus group interviews were circulated to other Grade 3 teachers (n = 5) and learners (n = 5) who were not part of the sample to determine the appropriateness of the questions and to review their clarity before the interviews were conducted (Booysen and Grosser 2008; Leedy and Ormrod 2005). We verified the data obtained from the semi-structured interviews afterwards with the teachers to ensure that the interpretations were correct. We were satisfied that we had achieved data saturation and therefore did not schedule follow-up interviews (Leedy and Ormrod 2005).

The trustworthiness of the semi-structured interviews was enhanced by the fact that the responses of the teachers to the cooperative teaching and learning intervention programme and the development of thinking skills could be compared with the responses of the learners after the focus group interviews as well as to the test results. The comparisons enabled us to determine similarities and differences, and to verify findings. Data were transcribed verbatim to ensure that the exact words of the participants were taken into account during the data analysis (Cohen et al. 2007). The interviews were held in the mother tongue of the participants and recorded to avoid any misunderstanding and wrong interpretations (McMillan and Schumacher 2006).

The trustworthiness of the focus group interviews was supported by the fact that rich data relevant to the research problem were generated. The groups were able to elucidate important aspects, which could have been lost during individual interviews.

For this study we used methodological triangulation (Cohen et al. 2007) to enhance rigour. The data obtained by the PPG test were controlled and verified against the data gained from the observations, the semi-structured interviews and the focus group interviews before any conclusions were drawn or findings reported (Merriam 2009).

**Ethical issues**

Since the learners were very young (Grade 3), the following necessary precautions were taken concerning ethical issues. After explaining the purpose of the research to all the parties involved, including the parents of the learners and the Gauteng Department of Education, written consent was obtained from all
those who participated in the research.
All the participants took part voluntarily, and learner participation was dealt with anonymously. The participants were not exposed to any risk of physical or psychological harm.

**Data analysis**

Our goal in the study was to provide results for the treatment effect of a cooperative teaching and learning programme on the thinking skills of Grade 3 learners. As our research involved a categorical independent variable and a continuous dependent variable, and there were more than two levels of the independent variable, an analysis of variance (Anova) was applied. Anova was applied to determine whether the changes in the test results that occurred within the two groups over time were statistically significant, and whether the experimental manipulation was generally successful (Field 2009).

The data analysis of the observations involved the calculation of means for the application of the various thinking skills according to a four-point scale of excellent (1), good (2), average (3) or can improve (4). By means of a content analysis, codes and themes were identified from the transcribed interview data.

**Results**

**PPG test results**

In Table 4, we report the mean scores obtained by the participants in the two experimental groups for each of the sections in the PPG test. The pre-test results (Table 4) for both experimental groups revealed that the two groups could execute the thinking skills on which the study focused fairly well. For all the test sections, the group of learners obtained good mean scores. These results prompted us to establish whether the thinking skills could be enhanced and or developed further.
The effect of cooperative learning on the thinking skills development of Foundation Phase learners

Table 4  Means obtained for the PPG test

<table>
<thead>
<tr>
<th>Section 1: Figure series, non-verbal: apply and evaluate</th>
<th>Experimental group A</th>
<th>Experimental group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Pre-test 1</td>
<td>30</td>
<td>15.00</td>
</tr>
<tr>
<td>Post-test 1</td>
<td>30</td>
<td>15.50</td>
</tr>
<tr>
<td>Post-post-test 1</td>
<td>30</td>
<td>16.20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section 2: Verbal reasoning: understand, apply and evaluate</th>
<th>Experimental group A</th>
<th>Experimental group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test 1</td>
<td>30</td>
<td>24.57</td>
</tr>
<tr>
<td>Post-test 1</td>
<td>30</td>
<td>25.20</td>
</tr>
<tr>
<td>Post-post-test 1</td>
<td>30</td>
<td>27.20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section 3: Pattern completion: analyze and create</th>
<th>Experimental group A</th>
<th>Experimental group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test 1</td>
<td>30</td>
<td>15.07</td>
</tr>
<tr>
<td>Post-test 1</td>
<td>30</td>
<td>16.13</td>
</tr>
<tr>
<td>Post-post-test 1</td>
<td>30</td>
<td>16.20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section 4: Verbal comprehension: remember, understand, apply and evaluate</th>
<th>Experimental group A</th>
<th>Experimental group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test 1</td>
<td>30</td>
<td>17.50</td>
</tr>
<tr>
<td>Post-test 1</td>
<td>30</td>
<td>18.03</td>
</tr>
<tr>
<td>Post-post-test 1</td>
<td>30</td>
<td>18.47</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test averages: Part 5: analyze and create</th>
<th>Experimental group A</th>
<th>Experimental group B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test 1</td>
<td>30</td>
<td>12.47</td>
</tr>
<tr>
<td>Post-test 1</td>
<td>30</td>
<td>13.23</td>
</tr>
<tr>
<td>Post-post-test 1</td>
<td>30</td>
<td>13.67</td>
</tr>
</tbody>
</table>

No statistically significant differences were noticed between the pre-test and post-test results of the two experimental groups after implementation of the intervention programme. This implied that both groups entered the research with a more or less similar cognitive ability, and the intervention did not benefit one group more than the other group.

The means obtained for each of the test sections by both experimental groups improved during the post-test that was written on conclusion of the intervention. To determine whether the changes over time that occurred within the two groups were statistically significant, Anova was conducted. The results of Anova are reported in Table 5.
Table 5 Anova results

<table>
<thead>
<tr>
<th>Test section</th>
<th>Group</th>
<th>n</th>
<th>Sum of squares</th>
<th>df</th>
<th>Mean square</th>
<th>F</th>
<th>Sig. p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Figure series</td>
<td>A Between groups Within groups</td>
<td>30</td>
<td>21.800</td>
<td>2</td>
<td>10.900</td>
<td>3.946</td>
<td>0.023*</td>
</tr>
<tr>
<td>non-verbal: apply &amp; evaluate</td>
<td>B Between groups Within groups</td>
<td>30</td>
<td>27.289</td>
<td>2</td>
<td>13.644</td>
<td>4.313</td>
<td>0.016*</td>
</tr>
<tr>
<td></td>
<td>A Between groups Within groups</td>
<td>30</td>
<td>113.356</td>
<td>2</td>
<td>56.678</td>
<td>5.037</td>
<td>0.0098*</td>
</tr>
<tr>
<td>2: Verbal reasoning: understand, apply, evaluate</td>
<td>B Between groups Within groups</td>
<td>30</td>
<td>232.800</td>
<td>2</td>
<td>116.400</td>
<td>10.601</td>
<td>0.000*</td>
</tr>
<tr>
<td></td>
<td>A Between groups Within groups</td>
<td>30</td>
<td>24.267</td>
<td>2</td>
<td>12.133</td>
<td>3.471</td>
<td>0.035*</td>
</tr>
<tr>
<td>3: Pattern completion: analyze &amp; create</td>
<td>B Between groups Within groups</td>
<td>30</td>
<td>40.289</td>
<td>2</td>
<td>20.144</td>
<td>6.506</td>
<td>0.002*</td>
</tr>
<tr>
<td></td>
<td>A Between groups Within groups</td>
<td>30</td>
<td>14.067</td>
<td>2</td>
<td>7.033</td>
<td>1.464</td>
<td>0.237</td>
</tr>
<tr>
<td>4: Verbal comprehension: remember, understand, apply, evaluate</td>
<td>B Between groups Within groups</td>
<td>30</td>
<td>78.289</td>
<td>2</td>
<td>39.144</td>
<td>8.131</td>
<td>0.001*</td>
</tr>
<tr>
<td></td>
<td>A Between groups Within groups</td>
<td>30</td>
<td>22.156</td>
<td>2</td>
<td>11.078</td>
<td>3.114</td>
<td>0.049*</td>
</tr>
<tr>
<td></td>
<td>B Between groups Within groups</td>
<td>30</td>
<td>35.622</td>
<td>2</td>
<td>17.811</td>
<td>2.645</td>
<td>0.077</td>
</tr>
</tbody>
</table>

*Significance: p < 0.05

Anova revealed statistically significant differences between the various results for the different test occasions linked to the thinking skills applied and evaluated for non-verbal figure series. The results revealed statistically significant differences of $p = 0.023$ (group A), and $p = 0.016$ (group B). The results obtained for the different tests for verbal reasoning that involved the skills of understanding, application and evaluation also revealed statistically significant differences of $p = 0.009$ (group A) and $p = 0.000$ (group B). Furthermore, statistically significant differences were also noted between the results for the different test occasions related to pattern completion that required the participants to analyse and create. Statistically significant differences of $p = 0.035$ (group A) and $p = 0.002$ (group B) were obtained.

One of the test sections revealed statistically significant differences between the various test occasions for group A only, namely non-verbal number series that required the participants to analyse and create. A statistically significant difference of $p = 0.049$ was calculated. Similarly, one of the test sections revealed statistically significant differences between the various test occasions for group B only, namely verbal comprehension, which involved remembering, understanding, applying and evaluating. A statistically significant difference of $p = 0.001$ was noted.

Based on the data reported in Table 5, both experimental groups benefited from the intervention with regard to all the thinking skills on which the test focused. To determine on which test occasions the
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statistically significant differences noted in Table 5 occurred, a post hoc test, namely the Tukey Honestly Significant Difference test, was conducted. In Table 6 the results obtained for group A are reported.

Table 6 Group A: Anova and Tukey HSD data

<table>
<thead>
<tr>
<th>Test section</th>
<th>ANOVA Sig</th>
<th>Group</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Sig. p</th>
<th>Cohen's</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Figure series non verbal: apply &amp; evaluate</td>
<td>0.023</td>
<td>Pre test 1</td>
<td>30</td>
<td>15.00</td>
<td>2.13</td>
<td>0.017*</td>
<td>0.563</td>
<td>Medium</td>
</tr>
<tr>
<td>Post-post test 1</td>
<td></td>
<td>30</td>
<td>16.20</td>
<td>1.21</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: Verbal reasoning: understand, apply, evaluate</td>
<td>0.009</td>
<td>Pre test 1</td>
<td>30</td>
<td>24.57</td>
<td>4.26</td>
<td>0.009*</td>
<td>0.617</td>
<td>Medium</td>
</tr>
<tr>
<td>Post-post test 1</td>
<td></td>
<td>30</td>
<td>27.20</td>
<td>2.36</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5: Number series: non-verbal: analyse &amp; create</td>
<td>0.049</td>
<td>Pre test 1</td>
<td>30</td>
<td>12.47</td>
<td>2.56</td>
<td>0.041*</td>
<td>0.468</td>
<td>Small</td>
</tr>
<tr>
<td>Post-post test 1</td>
<td></td>
<td>30</td>
<td>13.67</td>
<td>1.18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significance $p < 0.05$

Statistically significant results were noted only between the pre-test 1 and post-post-test 1 results for three of the test sections. Higher means were obtained in all the post-post-test 1 results.

For the non-verbal skills that involved application and evaluation, a statistically significant difference of $p = 0.017$ with a medium effect size of $d = 0.563$ was noted. For the verbal reasoning skills of understanding, applying and evaluating, a statistical significant difference of $p = 0.009$ with a medium effect size of $d = 0.617$ was calculated. Finally, for the non-verbal skills of analysing and creating, a statistically significant difference was also noted between the pre-test 1 and post-post-test 1 results: $p = 0.041$ with a small effect size of $d = 0.468$. Slight improvements in the application of thinking skills were noted between the pre-test 1 and post-test 1 results (Table 4), which could be attributed to the influence of the intervention.

However, these improvements were not statistically significant. Over time the intervention period proved to have had a positive influence on the thinking skills of the learners in group A.

Bearing in mind that post-post-test 1 was written after the 15-week period of normal class teaching, the retention of the thinking skills acquired through the intervention prior to the normal class teaching period was apparent. This retention could be linked to the fact that the learners applied the skills that they had acquired after the intervention, which aided their reinforcement and retention. In addition to this, the teacher, who was well qualified and experienced, could have intentionally nurtured the thinking skills during her normal class teaching, which also benefited the retention of the skills gained through the intervention. It could therefore be argued that a combination of intervention and class teaching was responsible for the improvement in the post-post-test 1 results of Group A. In Table 7, the Tukey Honestly Significant Difference test results for Group B are reported.
In contrast to group A, the results of group B revealed statistically significant differences between the pre-test 1 and the post-test (after the intervention) results, as well as between the pre-test 2 (written after normal class teaching and before the intervention) and the post-test results (written after the intervention). On conclusion of the intervention, mean gains were noted for the post-test results of all the test sections. Only for test section 5 (number series: non-verbal) was the mean gain of the post-test result not statistically significant.

The fact that no statistically significant differences were noted between the pre-test 1 and pre-test 2 results could imply that in contrast to group A, the normal class teaching that took place before the intervention with group B apparently did not purposefully nurture the development of thinking skills. For the non-verbal skills of application and evaluation, the following statistically significant differences between the pre-test 1 and post-test results, as well as between the pre-test 2 and post-test results, were noted: $p = 0.041$ and $p = 0.028$ with medium effect sizes of $d = 0.548$ and $d = 0.603$ respectively. The application of the verbal reasoning skills of understanding, applying and evaluating also improved in the post-test, and statistically significant differences of $p = 0.000$ and $p = 0.004$, with large effects in practice of $d = 0.873$ and $d = 0.864$ respectively were calculated. With regard to pattern completion, which required the learners to analyse and create, a statistically significant difference was observed between pre-test 1 and the post-test, as well as between pre-test 2 and the post-test; $p = 0.002$ and $p = 0.002$. 

---

**Table 7 Group B: Anova and Tukey HSD data**

<table>
<thead>
<tr>
<th>Test section</th>
<th>ANOVA Sig</th>
<th>Group</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Sig</th>
<th>Cohen’s d</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Figure series non verbal: apply &amp; evaluate</td>
<td></td>
<td>Pre test 1</td>
<td>30</td>
<td>14.93</td>
<td>2.08</td>
<td>0.016</td>
<td>0.548</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>30</td>
<td>16.07</td>
<td>1.08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-test 2</td>
<td>30</td>
<td>14.87</td>
<td>1.99</td>
<td>0.028*</td>
<td>0.603</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>30</td>
<td>16.07</td>
<td>1.08</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: Verbal reasoning: understand, apply, evaluate</td>
<td></td>
<td>Pre test 1</td>
<td>30</td>
<td>23.97</td>
<td>4.35</td>
<td>0.000*</td>
<td>0.873</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>30</td>
<td>27.77</td>
<td>1.87</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-test 2</td>
<td>30</td>
<td>24.97</td>
<td>3.24</td>
<td>0.004*</td>
<td>0.864</td>
<td>Large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>30</td>
<td>27.77</td>
<td>1.87</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: Pattern completion: analyse &amp; create</td>
<td></td>
<td>Pre test 1</td>
<td>30</td>
<td>15.03</td>
<td>2.17</td>
<td>0.002*</td>
<td>0.723</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>30</td>
<td>16.60</td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-test 2</td>
<td>30</td>
<td>15.40</td>
<td>1.90</td>
<td>0.026*</td>
<td>0.631</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>30</td>
<td>16.60</td>
<td>0.96</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: Verbal comprehension: remember, understand, apply, evaluate</td>
<td></td>
<td>Pre test 1</td>
<td>30</td>
<td>16.17</td>
<td>2.79</td>
<td>0.000*</td>
<td>0.799</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>30</td>
<td>18.40</td>
<td>1.56</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-test 2</td>
<td>30</td>
<td>16.87</td>
<td>2.04</td>
<td>0.022*</td>
<td>0.750</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Post-test</td>
<td>30</td>
<td>18.40</td>
<td>1.56</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significance $p < 0.05$
The effect of cooperative learning on the thinking skills development of Foundation Phase learners

0.026 respectively, with medium effect sizes of $d = 0.723$ and $d = 0.631$. The test section that centred on verbal comprehension and involved remembering, understanding, application and evaluation also revealed statistically significant differences between the pre-test 1 and post-test results, as well as between the pre-test 2 and the post-test results: $p = 0.000$ and $p = 0.022$, with medium effect sizes of $d = 0.799$ and $d = 0.750$.

Given the fact that for group B statistically significant differences were noted for four of the test sections directly after implementation of the intervention, we argue that group B benefited more from the intervention than group A. Although the test results of group A improved after the intervention, the mean gains were not statistically significant. Statistically significant improvements were only noted for the post-post-test 1 results, which indicate that a combination of intervention and classroom teaching contributed to the improvement in the results of group A.

Data obtained from the observations

The data obtained from the observations highlighted the latent potential of cooperative learning for the improvement of thinking skills, as mentioned in the literature (Johnson & Johnson 1994; Johnson et al. 2000; Webb et al. 2001). The observation data supported the progressive improvement noted in the test results for both experimental groups throughout the study, and our observations compared well with the observations made by the teachers. The observations confirmed that the cooperative learning intervention programme had a positive influence on enhancing the thinking skills of the Grade 3 learners. According to the observations, the thinking skills, which showed the greatest improvement in both groups, were understanding and remembering as noted in the test results for test section 2 for group A and section 4 for group B.

At the start of the intervention, our observations alerted us to the fact that the learners were not used to working in groups. They found it difficult to communicate with the other members in their groups. Everyone in the group wanted to do it their way as they did not have the skills to function in cooperative learning groups. As the cooperative learning intervention programme progressed, the learners slowly started to master the necessary skills to work together as a group, such as listening to one another, sharing ideas and evaluating and respecting one another’s ideas.

Data obtained from the semi-structured interviews

The data collected from the semi-structured interviews before the start of the intervention indicated that the learners still needed help and guidance in applying thinking skills. Both teachers pointed out that there are internal as well as external factors that influence the development of thinking skills. They mentioned internal factors such as intelligence, ability, autonomy, self-esteem and language proficiency, and external factors such as home and school environments, their peers and their teachers. Both teachers stressed the fact that a teacher has a vital role to play in developing thinking skills by means of guidance and giving instructions. They were both concerned about the learners’ lack of higher-order cognitive and meta-cognitive thinking skills such as analyses and evaluation of information.

On conclusion of the intervention, both teachers confirmed the potential of cooperative learning, especially for improving reasoning, analysing and evaluating. The teachers indicated that the cooperative teaching/learning intervention programme brought about improvement, especially concerning the following thinking skills: planning, reasoning, analysing, evaluating, understanding and choosing strategies for problem solving. Furthermore, during the interviews it was stated that the learners had started working more independently, systematically and purposefully. According to the responses of
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the teachers, they observed positive changes in the way the learners tackled their assignments. The learners appeared to approach their assignments in a more structured manner. They planned their work, communicated and reasoned more meaningfully when they had to solve problems as a group. According to both teachers, they were using different strategies to solve problems. They agreed that the learners displayed more self-confidence, they reacted more spontaneously and they tackled problems more purposefully. The teachers were pleased that they could observe an improvement in the learners’ social skills as well. They worked together in the groups, communicated and reasoned meaningfully and listened to one another.

Data obtained from the focus group interviews

The data analysis of the focus group interviews with the learners also indicated that they benefited from the cooperative teaching/learning intervention programme. We concluded that there had been an improvement in the application of the learners’ thinking skills as the learners mentioned that after the intervention programme, they tended to think first before they started to work, planned their work, argued before making final decisions, evaluated information and made choices before answering. In their responses, they referred to the benefits of cooperative learning as being able to work with others, deciding together, giving and getting help from others and that everybody contributes to, and bears responsibility for attaining learning outcomes. The following benefits regarding the development of social skills were also mentioned: learning to listen to others, not to interrupt someone who is talking and paying attention to what someone is saying.

In summary, positive and negative aspects emanated from the data gathered from the focus group interviews. The responses of the learners confirmed that cooperative learning assisted them in achieving a common goal, improved their listening skills, enriched their knowledge by allowing them to share ideas with their peers, enhanced their communication and reasoning skills and contributed to more effective problem solving and decision making. The learners pointed out that they used the ‘thinking train’ as a strategy to help them to solve problems. All the skills mentioned above signal an improvement in listening to one another, as everybody’s opinion is important. Furthermore, they learned to handle conflict and to take turns, and not shout out the answers. One of the negative aspects of cooperative learning that was reported was that certain learners did not cooperate with the group, which hampered the solving of problems or completion of tasks. The findings of our research revealed that the cooperative learning intervention supported learning and teaching in a culture of thinking (Tishman, Perkins and Jay 1995). A number of forces indicated by Tishman et al. (1995) to nurture a culture of thinking were present during the implementation of the cooperative learning intervention. These forces include a classroom climate that: encourages learners to take control of their learning, urges learners to build and use strategies, enables learners to go beyond factual knowledge and solve problems in different contexts, and develops attitudes and dispositions concerning thinking (Tishman et al. 1995).

The triangulation of quantitative and qualitative data confirms the improvement in the application of the learners’ thinking skills. The null hypothesis (H0) that was formulated at the outset of the study is rejected and the alternative hypotheses, Ha1 and Ha2, are accepted as the data indicated that the intervention programme contributed to statistically significant differences between the application of the learners’ thinking skills before and after the implementation of the intervention programme. For group B in particular, the intervention programme proved to benefit the development of thinking skills. For group A, the benefits appeared to be more limited and the slight improvements noted after the implementation of the intervention were reinforced and advanced by normal class teaching. It was clear from the results obtained, that more than just academic learning took place. Social skills such as listening to others and handling conflict, as well as enhanced communication and reasoning skills
improved. In addition, executive functions that enable learners to plan their work better, work more purposefully and apply meta-cognitive thinking before starting a task appeared to have benefitted from the intervention.

**Discussion**

The findings of this research support the argument of De Bono (1983), Dewey (in Wegerif 2002) and Wallace (2002), who indicate that it is possible to develop thinking skills and/or improve them further. This pronouncement is supported by the improvement in the test results of both experimental groups A and B. According to Joubert et al. (2006), it is possible that Foundation Phase learners can be led by the teacher to learn and apply thinking skills. The improvement of thinking skills, which was observed in experimental groups A and B at the conclusion of the intervention programme, therefore supports this finding in the literature that it is possible to develop thinking skills in the Foundation Phase (Butt 2000; De Wit 2009; Lerner and Kline 2006; Troutman and Lichtenberg 2003).

In support of the literature, the findings of the research emphasize the important role, which the teacher can play in the development of thinking skills. In particular, our research emphasised the important role and contribution that teachers can make in the creation of a classroom climate, which promotes intellectual openness (Briggs and Sommerfeldt 2002; De Wit 2009; Lidz and Gindis 2003; Mayer 1999; Rudd 2007; Troutman and Lichtenberg 2003; Vakalisa 2007; Wallace 2002; White-Clark, Dicarlo and Gilchriest 2008; Woolfolk 2004). The cooperative teaching and learning programme provided evidence of how a teacher can purposefully utilise teaching methods to structure opportunities for enhancing the development of thinking skills and bring about transformative learning in contrast to pure assimilative learning. We base our argument on the fact that the learners received multiple opportunities to construct knowledge and share ideas instead of merely receiving information from the teacher. Transformative learning involves the learners actively in the teaching/learning process, allows their own construction and questioning of knowledge and offers the opportunity for dynamic social interaction during teaching and learning (Briggs and Sommerfeldt 2002; Gawe 2007; Grabe and Grabe 2004; McGonigal 2005; Mezirow 1997; Zuckermann 2003). According to McGonigal (2005), thinking skills development is stimulated by transformative learning that focuses on problem solving and class discussions.

The data indicated that the three dimensions of executive functions, which involved the acquisition and application of cognitive and meta-cognitive skills and strategies that aid memory capacity, inhibitory control and cognitive flexibility, seemingly greatly benefitted from the learners’ involvement in the cooperative learning intervention. From the data, it could be deduced that the learners became better at planning their work, approaching work in a more structured manner and working less impulsively, which could point to an increase in capacity to apply executive functions related to inhibitory control (Diamond 2006; Ritchhart and Perkins 2008). Cognitive flexibility developed as learners appeared to be more able to adjust to changing cognitive demands that required the application of different cognitive skills (analyse, reason, evaluate, create) and strategies (problem-solving, decision-making) (Diamond 2006). Learners appeared to be more apt at complex thinking and goal-directed planning, which could be a sign, that the working memory’s capacity to hold and manipulate information is increasing (Diamond 2006; Luna et al. 2004). In this regard, and with specific reference to the quantitative data, the thinking skills, which showed the greatest improvement, were understanding and remembering.

In support of cognitive modifiability theory (Feuerstein et al. 2010; Feuerstein et al. 2002), the cooperative learning intervention that focused on a purposeful interactional process that modelled and mediated the application of skills and strategies to learners, possibly contributed to the acquisition of cognitive abilities that might have been absent or fragile among the learners who took part in the research.

Although the study did not focus on the effectiveness of normal class teaching, it is necessary to refer to
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it, especially as it became clear that the class teaching of the teacher of experimental group A contributed to the advancement of thinking skills. The statistically significant test results of experimental group A on conclusion of ordinary class tuition supports this finding. In the period during which experimental group A received ordinary class tuition, significant results were observed in the improvement of the thinking skills of applying and evaluating. This suggests that although the teacher did not use cooperative learning intentionally, she presented her teaching/learning to group A in a way that actually brought about transformative learning in her learners.

Although communication and modelling of skills and strategies are central to all teaching, a cooperative learning approach places stronger emphasis on the explicit modelling and mediation of thinking skills and communication between teachers and learners and also among learners themselves (Johnson and Johnson 1984). Cooperative learning provides opportunities for argumentation, clarification of arguments and challenging one another's arguments, which rely on communication. Furthermore, teachers have to mediate and model the cognitive skills and social skills required for the completion of activities (Johnson and Johnson 1984).

We argue that the reciprocal nature of the modelling and the communication during cooperative learning possibly contributed to the success of the intervention for developing thinking skills. The importance of modelling and communication with regard to thinking skills development is widely reported in the literature (De Wit 2009; Donald, Lazarus and Lolwana 2006; Johnson and Johnson 1994; Langford 2005; Schayer 2000; Troutman and Lichtenberg 2003; Wallace 2002; Wegerif 2002). The modelling of thinking skills was inculcated and practised until the learners made these skills their own and could use them at a suitable time to solve problems.

Throughout the programme, communicating and comparing ideas and solutions to problems among the learners, as well as among the learners and the researchers, characterized the execution of every learning activity over the fifteen weeks of the intervention programme. It is likely that the statistically significant improvement in the test results attained on conclusion of the intervention programme could be attributed to the role of modelling and communication.

A gratifying fact that emanated from the study is that the teachers who taught the learners taking part in the study prior to Grade 3 probably concerned themselves with thinking skills development. The good pre-test results of the learners may point to the fact that deliberate attempts had been made in Grades 1 and 2 to promote the cognitive development of the learners who took part in the study. It also became apparent that the many years of teaching experience that the teacher of experimental group A had, probably contributed to the fact that her teaching and learning interactions enhanced the learners' thinking skills. This observation is in contrast to the viewpoint of Troutman and Lichtenberg (2003) and Vorster (2001) who argue that developing thinking skills is not normally high on teachers' agendas.

According to the reaction of the learners during the focus group interviews, it appears that they enjoyed the activities during the cooperative teaching/learning programme. The learners insisted that every learner should have a specific role to play during the cooperative learning. It is important that everyone in the group should know precisely what to do to ensure success of the group. The learners also highlighted the necessity of social skills in cooperative learning, that is, it is important to listen to another, appreciate one another's opinions and respect one another. The learners emphasised that when someone talks to you, you must look at that person and think about what he or she is saying. We noted that cooperative learning had benefits for the development of thinking skills as well as social development as cited in the literature (Bjorklund 2005; Eggen and Kauchak 2004; Gawe 2007; Gunter et al. 2003; Ormrod 1995; Slavin 1987; Woolfolk 2004; Zuckerman 2003). In this study, the focus was on the improvement of thinking skills through cooperative learning. With the successes accomplished as evidenced by the data obtained, we can cautiously assume that the aforementioned argument appears to
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hold true in the context of the study.

The cooperative teaching and learning programme offered support to the learners in terms of physical resources, emotional support, social support, a sense of belonging and opportunities to share and critically evaluate information that promoted transformative learning and cognitive development. Based on the findings of the research we carefully conclude that cooperative learning can be used with success at Foundation Phase level to develop thinking skills. In addition to developing thinking skills, the curriculum aims also expect of teachers to develop the social skills of all learners: ‘to work effectively as individual and with others as members of a team’ (Department of Education 2011:5). Furthermore, social justice at the level of policy, which aims to develop values towards democracy, human rights and non-racialism (Karikan and Ramsuran 2006) may be promoted through cooperative learning where listening to and learning from what others have to say are central to the teaching and learning process (Jansen 2008). Cooperative learning paved the way for ‘pedagogical reciprocity’ (Jansen 2008:73) and a ‘pedagogy of compassion’ (Jansen 2008:59), where a teaching and learning atmosphere in which the starting point is the recognition of the humanity of one another, is created (Jansen 2008).

We are of the opinion that this particular aim can be achieved by using cooperative learning in the classroom. Furthermore, we argue that the earlier the learners are exposed to social learning, the easier it will be for them to deal with social learning in the higher grades. Although social learning might not be the learning style preference of many learners, Felder (1996:18) argues that teaching should help learners to build skills in both the preferred and less-preferred styles of learning.

In the context of the study, a number of limitations could have compromised the data collection. Time can be seen as a limitation, as the 15 weeks’ duration of the study was insufficient to determine the long-term effects of cooperative learning on the development of thinking skills in the classroom. In addition to this, the sample was small and culturally bound. The fact that the teachers were part of the observations, could have influenced them to use different teaching strategies during normal class teaching, which in turn could have influenced the post-test results of experimental group A. Due to time constraints, a second post-test for experimental group B was not conducted, and we could not establish which of the thinking skills were retained.

The reliability of the results could have been influenced by the fact that we had gained more experience during the intervention programme with experimental group B, which placed experimental group B in a more favourable position in terms of the effectiveness of the intervention. We are also aware that motivation, normal maturation and concentration could have influenced the results. The Hawthorn effect could also have had an impact on the results, as the learners may have changed their behaviour deliberately, as they presumed that it was expected of them to react in a certain way (Cohen et al. 2007). Observation was done globally without specifically looking at individual learners’ progress, and important progression moments could therefore have slipped through.

Although we have highlighted a number of limitations, a prominent preliminary finding emerged from our research, namely the effectiveness of cooperative learning for the development of thinking skills among Foundation Phase learners. In view of this finding, the merits of cooperative learning for the thinking skills development among Foundation Phase learners need to be further determined.

**Conclusion**

One cannot simply assume that the development of thinking skills takes place at home, and that every child possesses the necessary thinking skills when coming to school. Even if a child is exposed to the development of thinking skills at home, they need to be taught thinking skills in the context of academic learning as well.
Thinking skills have to be taught, and cooperative learning appears to be a suitable teaching and learning strategy to achieve this aim. Teachers in the Foundation Phase are thus faced with the challenge of nurturing the development of thinking skills to provide the necessary foundation for teachers in the intermediate and senior phase to build on. If no intentional efforts are made to develop the thinking skills of learners, the Critical and Development Outcomes of the NCS and the aims of the CAPS will remain ideals and not become reality in the classroom.

References


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