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Institut für Bildung im Kindes- und Jugendalter
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Final report on the research project of the German Federal Ministry of Education and Research (BMBF)

Promoting Literacy Acquisition and Mathematics in Kindergarten and Primary School based on the Piramide approach

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"Piramide" project - Promoting literacy acquisition and mathematics in kindergarten and primary school with the Piramide approach

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1 Short description

1.1 Scope of tasks

The objective is to determine which effects promoting aligned education processes in *kindergarten and elementary education* within the scope of “Piramide”, a holistic pedagogical universal approach, has *compared to other approaches*.

The quasi-experimental study is based on various criteria from the two areas of literacy acquisition and mathematics as well as the concept of one’s self and the joy of learning specific to each area. For comparison purposes, the study also looks at a non-domain-specific forms of promoting education (control group), domain-specific learning support based on learning paths (KIDZ-approach) as well as a domain-specific support based on course work ("letter land & number land approach"). The latter two treatments are part of the FaBi project (Promoting aligned education processes) of the DFG Graduate School Teaching & Learning Processes (UpGrade) at the University of Koblenz-Landau, with which the Piramide study is closely linked conceptually.

The close relationship is due the fact the Piramide study was designed in a similar way as the FaBi study conducted one year earlier. On the one hand, it was used to gain experiences in this project (e.g., the use of surveys); on the other hand, and much more importantly, the existing data is used to compare promoting education through the Piramide approach versus other approaches. This is a very economical approach, as it will no longer require elaborate and expensive surveys in a control group or in other treatment groups.

This present report focuses on the first phase in promoting education, by looking at the development of the children during their last year before school enrolment. In a second phase, the study will follow the children’s development until the end of first grade.

1.2. Project parameters

Due to various excursions and school visits by students at the initial Piramide facilities in Germany (in Wiesbaden), the project had already established a good level of contact with Cito Germany before the project began. Cito Germany is a testing development institute based in the Netherlands which, in addition to testing instruments, offers education concepts and training programs and which distributes the widespread Piramide concept developed there; it is also in charge of issuing certification for the program. The institute presented the addresses of the schools in Germany that implement Piramide and provided information on which certification stage each individual institution has reached. This made it easier to conduct the field work.

As this project is closely linked to the FaBi project in the DFG Graduate School Teaching & Learning Processes (UpGrade), there were very favorable conditions for the project, as we were able to largely conduct it in parallel and in close cooperation with FaBi, and the data collected in FaBi were used for differentiated analyses in this present study.

1.3. Planning and procedure of the project

The project procedure was largely completed in line with the pre-arranged resource-based work schedule. Both collecting the random sample as well as completing the surveys of the children at both measuring times were implemented on schedule; for the second survey there were some delays due to the large number of appointments before the summer vacation. The video recordings of the teacher-child interaction, which were carried out at the same time as the surveys of educational quality, were completed within the scheduled period. The collection of the socio-economic backgrounds of the parents was also carried out as planned.

Changes were made in the collection of didactic knowledge of the experts as well as the contextual conditions of transition and cooperation. It was shown that focusing on the areas and levels of cooperation and the implementation of Piramide approach (expanding on the project proposal) is much more important than ensuring that the teacher acquires specific pedagogical knowledge. In particular, the visits to the schools where Piramide is applied and the two meetings with representatives of Cito Germany showed that it is necessary to focus on the implementation of Piramide and Piramide-specific programs. Only certified schools took part in the study, but even this specific random sample clearly showed that the approach was implemented very differently at the various institutions. The differentiated assessment of the quality of implementation is therefore of primary importance, as it can be assumed that it is less the fact *that* the approach is implemented, rather what it is important is *how* it is implemented.

1.4. State of the science on which the approach is based

Findings on promoting domain-specific education processes in Germany have so far remained primarily associated with highly regimented training programs that are designed for children at risk and are usually implemented without regard for everyday life in kindergarten (e.g., “Mengen, zählen, Zahlen” (“Amounts, counting, numbers”) by Krajewski, Nieding & Schneider, 2007; or “Hören, lauschen, lernen I und II” (“Hearing, listening, learning I and II”) by Küspert & Schneider, 1999; Plume & Schneider, 2004). There have been very few empirical studies on promoting early mathematical and literacy skills in all children (Lenel, 2005). There are, however, differentiated insights from empirical studies of intervention programs in the United States. The holistic “Piramide approach”, which has been applied at only a few schools in Germany and which also contains elements of domain-

specific learning support, has already been studied in the Netherlands, albeit without a focus on domain-specific learning support (in summary, Kuyk, van 2009b).

A further basis for the project are the findings of the FaBi study (promoting aligned education processes) of the DFG Graduate School Teaching & Learning Processes (UpGrade) at the University of Koblenz-Landau, which is conceptually closely linked to the Piramide study. The findings on the comparison of the effects of these three treatments (excluding Piramide) can be found in Donie, Kammermeyer & Roux (2013).

1.5. Cooperation with other research centers

The project enjoyed close cooperation with the DFG Graduate School Teaching & Learning Processes (UpGrade). On the one hand, Verena Kathmann took part in the research training group. On the other hand, there were on-going conversations on the progress of the two research projects, which ran in parallel yet were offset by one year, with the graduate assistant Christian Donie, who headed the FaBi project (and who sometimes was even working in the same office).

In addition, at the beginning of the project in February 2011, attempts were made to establish contact with an American research group that, according to Cito and information material, is conducting a similar study. Unfortunately, they did not respond to our request for cooperation despite several attempts.

In addition, there were also two meetings with the representatives of Cito Germany during the report period. The first meeting took place at the University of Koblenz-Landau, Landau Campus on Dec. 16, 2010. The meeting focused on gaining information that may be relevant for the field work. The meeting led to a decision on criteria for including groups in the random sample; the criterion of certification turned out to be of central importance. At the second meeting on Oct. 20, 2011, also held at the University of Koblenz-Landau, the participants discussed the progress of the surveys, on the one hand, and possible explanations behind the experiences gained, on the other hand. Of central importance for the project was finding out more on the certification procedure and particularly which role the relevant quality criteria for the project have. It was important to see that certification depends more on external surface features (such as use of materials, implementation of projects) rather than quality features on the deep structure level (such as the interactions based on the 4-step method that is central to the approach: orientation - demonstration - broadening - deepening).

2 Detailed description

2.1 Use of the funding and obtained results in detail, comparison of predetermined goals

2.1.1 Objective

In the past ten years, growing recognition of the importance of early education has led to a discussion on the "correct" way of promoting early childhood education. This discussion has recently gained steam regarding both school enrolment and the school-based, domain-specific promotion of education, as there are fears that kindergarten could become "regimented" as if they were schools. The debate is largely influenced by traditions, conviction and experience, and less by reliable empirical studies.

The goal of this study is to determine which effects promoting aligned education processes in kindergarten within the scope of *"Piramide", a holistic pedagogical universal approach*, have *compared* to *other approaches*. The Piramide approach of Kuyk (2003; 2009a, b), which is at the center of the study, was developed in an education system (without transitions) (Netherlands) for six-year-olds and has been adapted for the German system and can be applied in day-care facilities and primary schools. Piramide is used extensively in the Netherlands, and it has been implemented in the United States, Japan, and Belgium; it has also been applied at several schools in Germany since 2004.

2.1.2 Description of the Piramide approach

The Piramide approach is a "holistic" early education concept that, for over 15 years, has been applied as a pedagogical program at approximately 40% of all schools in the Netherlands and since 2004 also at German day-care facilities and cooperating primary schools (e.g., in Wiesbaden and Karlsruhe). The approach is based on the eight development areas of perception, thinking, language, orientation in time and space, the development of motor skills as well as artistic, socio-emotional and personality development. The methodological basis consists of playing activities initiated by the child and suggestions made by the preschool teacher within each project that is related to a specific topic; these projects usually last four weeks (e.g., on home, spring, clothing), and there are specific project books that feature differentiated suggestions for implementing these projects. In addition, a so-called "tutoring program" helps to specifically support children with special needs so that they can actively participate in everyday life in kindergarten. There are three different levels of intervention:

- At the *low level of intervention*, the preschool teacher almost entirely refrains from intervening in the children's playing and learning activities, opting instead to observe them.
- At the *intermediate level of intervention*, the preschool teacher introduces topics and activities to the children; she provides a minimum of support during independent learning activi-

ties and enriches the children's play with brief suggestions. Overall, the pedagogue's level of activity is equal to that of the children.

- At the *high level of intervention*, the preschool teacher plans and designs the tutoring either with each individual child or in small groups. She preemptively prepares the children with special needs for the following group topics and activities.

A central role in the Piramide approach is given to the *quality of the teacher-child interaction*, which presumably is essential for a smooth transition and the successful design of aligned education processes. The quality of this interaction is brought into focus by applying various strategies to stimulate the learning process. These strategies are:

- *Orientation* (i.e., the children reconnect with what they already know),
- *Demonstration* (i.e., explanations are provided that give the children the opportunity to gain a better understanding of the topic),
- *Broadening* (i.e., suggestions are made on how the children can expand on what they already know by connecting this to what they have just learned) and
- *Deepening* (i.e., the children learn how to make connections beyond what they see. They move away from the "here and now"; instead, they concentrate on finding their own solutions for problems and challenges) (Meyerhoff & Rausch, 2007).

2.1.3 Theoretical foundations

- of the Piramide approach

The Piramide approach is based on various theoretical foundations: *Piaget* established that children should learn and discover on their own, while *Vygotsky* argued that children should learn together with the support of adults. The Piramide approach combines these two views, placing great importance on ensuring that the pedagogue/teacher finds the balance between giving children freedom to learn on their own and providing the right amount of support. Another foundation of the Piramide approach is Theory of Attachment (e.g., Bowlby, 1995), in which the need for a trust relationship (nearness) between child and pedagogue/teacher comes to the fore. Conversely, it also considered important to support children's development by taking distance from "here and now". This assumption is based on the "*Distancing Theory*" by Sigel (1982).

The Piramide approach by Jef van Kuyk (2009b) is "holistic" while at the same time domain-specific. It therefore complies with important requirements that are called for in the current debate on education. With its holistic approach, it takes into account the elementary educational tradition and the

acquired domain-specific competences (e.g., literacy acquisition and mathematics) as well as the findings that school enrolment does not represent a "beginning point" and that supporting children's learning is already necessary in kindergarten.

- of the typology of learning support approaches

The "holistic" Piramide approach is compared to both a *course-based* and a *learning-path* approach, a distinction first suggested by Kirschhock (2004).

The central common feature of the three approaches is the content. All three approaches show that they explicitly promote specific skills in the areas of mathematics and literacy. The differences lie in the methodological approach.

Course-based approaches are characterized by the fact that they are based on the learning object and its inherent logic; they are based on small and equal steps geared towards a specific learning objective, and the teacher plays a dominant role. The advantage of such an approach is that it provides structure, a "boundary" inside of which the learning process takes place. The two domain-specific approaches of a "number land" and "letter land" by Friedrich and Galgoczy (2008a, 2008b), in which the numbers one through ten and the letters are successively introduced, can be classified as course-based approaches.

Learning-path approaches are characterized mainly by a high level of initiative of the child, the highly developed educational dimension, a low level of limits (Siraj-Blatchford, 2007) or situation orientation (Kluczniok, Rossbach & Large, 2010). A central aspect of these approaches by Kirschhock (2004) is not the inherent logic of the object; rather the focus is on the child and his/her learning process. This is an open approach, in which there are no concretely defined methodological forms of implementation due to the differences between the children. Emphasis is placed on linking the learning processes with the children's personal experiences and having the children take part in decisions. A recent example for such a learning-path approach in Germany is the KIDZ approach (Kindergarten der Zukunft in Bayern; Education Pact of Bavaria, 2007).

Compared to the other two approaches, the *Piramide approach* distinguishes itself by the fact that promoting domain-specific skills is integrated into an educational concept with the following features:

- balanced relationship between the child's own initiative and that of the teacher,
- integrating activities on mathematical and literacy skills into meaningful long-term projects,

- selective suggestions for domain-specific development processes based on the ODBD method (orientation – demonstration – broadening – deepening)

As the Piramide approach is a holistic pedagogical universal approach, in which the overall learning support is based on overarching principles, we can expect that it would perform better than approaches that focus merely on certain domains.

2.1.4 State of the research

- on aligned education processes

In terms of promoting aligned education processes, certain aspects in developmental psychology are significant for children aged four to eight years old. According to Hasselhorn (2005), children in this age group are characterized by cognitive disadvantages due to limitations in their working memory. Conversely, these disadvantages stand in opposition to motivational advantages, such as the joy of learning and an inflated self-concept. The children believe that they can learn anything by putting their minds to it. Such motivational benefits can be used to promote phonological awareness in children and to encourage them to acquire knowledge of literacy and knowledge of quantities and numbers. It should be pointed out, however, that the possibilities of structured, systematic learning in this age group are significantly limited due to their level of maturity.

Findings on promoting domain-specific learning processes in Germany have so far remained primarily associated with highly regimented training programs that are designed for children at risk and are usually implemented without regard for everyday life in kindergarten (for mathematics there is “Mengen, zählen, Zahlen” (“Amounts, counting, numbers”) by Krajewski, Nieding & Schneider, 2007; for literacy acquisition there is “Hören, lauschen, lernen I und II” (“Hearing, listening, learning I and II”) (Küspert & Schneider, 1999; Plume & Schneider, 2004). Despite this, there have been very few empirical studies that explore the extent to which competences developed through education in all children at German kindergartens and in early education settings in the context of an overall educational approach can be promoted in an aligned way (e.g., on literacy acquisition by Lenel, 2005). However, there are differentiated findings from empirical studies on intervention programs in the United States. They show, on the one hand, that domain-specific learning support integrated into everyday life is possible, for example, in mathematics with “Building Blocks for Math” by Clements and Sarama (2007), in literacy acquisition with “Doors to Discovery” from the Preschool Curriculum Evaluation Research (PCER) Consortium (2008). On the other hand, they also demonstrate that it is possible to successfully promote an overall educational concept, such as the “Tools of the Mind" approach by Bedrova and Leong (1996), which is based on Vygotsky’s theories.

- on quality in day-care facilities

However, the quality in kindergarten and early education settings depends *not only on the implemented learning support approach* and *contextual conditions*. There is evidence that shows that learning support programs are implemented differently by teachers and adapted to the specific conditions of their group (e.g., in the area of language: Schakib-Ekbatan, Hasselbach, Roos & Schöler, 2007; in the area of mathematics: Pauen & Pahnke, 2008). The first major longitudinal study in Europe, EPPE, and the subsequent best-practice study REPEY on the development of externally supervised children (Effective Provision of Preschool Education (EPPE) by Sylva, Melhuish, Sammons, Siraj-Blatchford, Taggart & Elliot, 2004, Research in Effective Pedagogy in the Early Years (REPEY) by Siraj-Blatchford, Sylva, Muttock, Gilden & Bell, 2002) also show that the effects of learning support are substantially linked to stimulating pedagogue-child interactions. As a central feature of preschool quality, this study identified what is called "sustained shared thinking".

An empirically proven model on the quality of pedagogue-child or teacher-pupil interaction which distinguishes between the quality of emotional support, the quality of the organization of the learning situation and the quality of instruction is provided by La Paro, Pianta and Stuhlman (2004). Their corresponding survey instrument CLASS (Classroom Assessment Scoring System; Pianta, La Paro, & Hamre, 2008) is used to collect data on the central variable "quality of the pedagogue-child interaction/teacher-pupil interaction" in the present study.

The "mega-study" by Hattie (2009; Hattie, Beywl & Zierer, 2013), which has been receiving considerable attention in the German educational research, provides evidence that the educational quality in kindergarten and, in this particular case, the specific quality of pedagogue-child interaction in the development of the child plays a central role and is possibly more important than the learning support approach. In this survey of over 60,000 empirical studies and approx. 245 million pupils Hattie draws on an unprecedented database to investigate what is proven to be effective. Hattie (2009) comes to the conclusion that the characteristics of the quality, and not the methods, structures and frameworks, are crucial for learning processes. The quality of support (or cognitive activation) is one of the factors that the Hattie study identifies as particularly effective. The goal should be in providing challenging, thought-provoking questions, rather than mere questions about facts. The Piramide approach with its "4 steps" of orientation – demonstration – broadening – deepening offers a methodical tool for ensuring a central element of this process quality.

- the Piramide approach

The “holistic” Piramide approach, which forms the basis of the proposal, has already been examined in several studies in the Netherlands (in summary, Kuyk, 2009b). In an initial external evaluation by the University of Groningen from 1996-1999, observations not only showed that 85% of children became very involved with the project materials, but also that Piramide demonstrated weak to moderate effects in the reduction of risk children compared to the Kaleidoscope approach. In a second study, the Amsterdam study from 1998-2000, the observation data showed that the Piramide approach is effective even under less favorable circumstances (Kuyk, 2009b). The children in the Piramide program scored better in literacy and cognitive ability compared to the Kaleidoscope approach (Kuyk, 2009b). A third study that sought to establish best practices included the results of the study by Veen, Roeleveld and Leseman (2000; see Kuyk, 2009a, p. 220). The following effects in favor of the Piramide approach were verified: Language: .29, Thinking: .35, Mathematics: .88. The results of the study by Goede and Reezigt (2001; see Kuyk, 2009a, p 221) were even more positive, with an effect size for language of 1.08 and .73 for mathematics.

The effectiveness of the Piramide Approach to Early Learning was examined in a recent study in the United States by Bingham, Kwon and Barrett-Mynes (2012). Following the use of the Piramide approach for two years, the classroom quality in the Piramide approach was analyzed to compare experimental and control groups and the effect on children’s development. This study shares a number of similarities with the present Piramide project. As a result of the US investigation it can be said that although the teachers using the Piramide approach had higher values in the various indicators for classroom quality compared to the control group (especially in teachers’ support of emotional development and in classroom design of learning environments), this did not lead to different child outcomes on the measures of language, cognitive or social skills in the first year. However, in the second year the children in the Piramide program demonstrated differences in language skills. It should also be noted that in the first year of the study, the teachers were learning how to implement the Piramide approach and this may account for stronger finding in the second year. For the present study, the authors’ conclusions appear to be particularly significant: Although the study shows some advantages of the Piramide approach compared to the typical educational approach, it is evident that these are not necessarily visible during the study. Since it may well be that these benefits come to light at a later date as teachers become more skilled in implementing the approach, the authors consider longitudinal studies necessary to analyze the long-term effects.

2.1.5 Questions and hypotheses

The present study investigates the following questions:

Does the Piramide approach differ from the domain-specific learning support approaches of a "*course-based* orientation" and a "*learning-path* orientation" and a control group with regard to performance, a self-concept and the joy of learning in the areas of mathematics and literacy?

Given the current research, it can be assumed that children who are promoted in domain-specific settings (*course-based orientation*, *learning-path orientation and Piramide approach*) achieve better performances in literacy acquisition and mathematics than children who receive a general, unspecific daily instruction (*control group*). In addition, we can expect that learning support that is integrated into a "holistic" overall educational approach based on Piramide will not only yield better results than a control group but also an integrated learning support that deals with only these specific domains. Moreover, it can also be expected that children in the Piramide setting demonstrate an improved development compared to the other two approaches, as the quality of interaction (ODBD method) plays an important role in this development, as shown in the current research. We can only expect this presumed advantage of the Piramide approach, however, if we also assume that a high level of educational quality in learning support is what places a special demand on the teacher. Therefore, we can also expect that the most significant variable is the quality of the educational process, as reflected in the quality of teacher-child interaction.

We can assume that all children will demonstrate high levels of a self-concept and a joy of learning in the specific domains, yet there will no differences between the groups.

2.1.6 Creation and implementation of the study

- Random sample

The random sample design of the Piramide project was created in parallel to the FaBi project at five schools, each with 25 preschool children. These were to be selected from a pool of the 35 kindergartens that, according to Cito, currently implement the Piramide approach in Germany. We were able to reach our goal, as a total of 110 preschool children from five kindergartens in the states of Baden-Württemberg, Hesse and North Rhine-Westphalia took part in the Piramide study. The following criteria were used in the selection process:

- Piramide certification (completion of all necessary training programs)
  by December, 2010
- Distance from the project site (Landau) to the institution not exceeding 350 km
- Sufficient number of preschool children

- No special situation at the institution (e.g., school entry level, Muslim day-care center)

However, unexpected and unpredictable difficulties arose during the random sample. These were due to the fact that only nine of the 35 kindergartens that, according to Cito, currently apply the Piramide approach actually met the required criteria. Of these nine, only five of the schools agreed to take part in the study. In order to avoid reducing the random sample even more, an institution that had declined to have their pupils recorded on video was then included in the random sample.

However, the original number of 110 preschool children as listed by the kindergartens decreased, as some parents did not give consent for their children to take part in the study, some children switched schools or their enrolment was deferred. During the specific surveys, it was also surprising that some of the preschool children were integrative children with mental impairment. As such, these children also had to be excluded from the random sample. Therefore, the sample at the first time of measurement is N = 95.

The *contact with the schools* and the *cooperation* ran smoothly. Among other things, this was due to the *institution shadowing visits*. Before the surveys began, the project staff member visited two schools in Wiesbaden and Karlsruhe for several days in April and May 2011 to learn more about the Piramide approach as it is put into practice. In addition, she took part in a meeting of the quality committee of the Piramide schools in Wiesbaden and in team meetings and telephone conferences to present the project and the random sample in February 2011. In addition, throughout the term of the project, different measures for maintaining the random sample were used. Particularly in such longitudinally designed studies, this is very important in order to narrow down what is called panel mortality and to increase the return rate of the survey instruments used. The children and teachers who participated in the study were given incentives, and the schools were given an informational poster for working with the parents.

- Surveys at the child level

Using the instruments described below, the surveys of the children were carried out as planned after a three-day training program for the student assistants in the fall of 2011. A few follow-up surveys were completed by the end of November, 2011. The second survey phase covered the period from May to July, 2012, allowing for a period of at least six months between the two measuring times.

The *selection* of survey instruments to record the children's literacy and mathematics skills as well as their self-concept and joy of learning in these two areas was based on experience gained in the FaBi project.

The instrument "wortgewandt & zahlenstark" ("eloquent & strong in numbers") (Moser & Berweger, 2007) was used to measure the performance in mathematics and literacy. This employs the three scales of "phonological awareness", "knowledge of letters and first reading experience" and "numerical/math skills".

The joy of learning and the self-concept of children were measured in the specific domains based on the "pictorial scale for recording the joy in learning and self-concept in mathematics and literacy in preschool children". Based on the method by Harter and Pike (1984) and its German version by Roux and Wolf (2004) as well as its expansion by Roux, Kammermeyer Schneider and Stuck (2009) as a domain-specific adaptation in the FaBi project by Roux, Kammermeyer, Donie & Kinnunen (2010), this scale was developed further and tested. It includes seven items for the domain of mathematics (counting, recording quantities, sorting, writing numbers, creating patterns, measuring, weighing) and seven items for the domain of literacy (writing, reading, distinguishing scripts, creating stories, recognizing letters, rhyming, inventing words). The internal consistency for the domain-specific joy of learning is $\alpha = .83$, for the domain-specific self-concept it is $\alpha = .84$.

The recorded covariates were non-verbal intelligence, vocabulary and the socio-economic status of the children.

Non-verbal intelligence was measured on paper with colored progressive matrices (CPM) (Becker, Schaller & Schmidtke, 1980 Raven, Raven & Court, 2001).

The socio-economic background was measured in a parent questionnaire (N = 53; rate of return of 56%). The questionnaire included inquiries on the parent's level of education, monthly household income and each family's cultural capital. The evaluation of the parent's level of education was done separately for the father and mother by means of the CASMIN classification (Comparative Analysis of Social Mobility in Industrial Nations) by König, Lüttinger and Müller (1988; Lüttinger & King, 1988) in an updated version according to Brauns and Steinmann (1999). Each family's cultural capital was operationalized according to Klein and Biedinger (2009). All data were also collected in the control group.

- Surveys at the teacher level

The third step focused on *surveying the teacher-child interaction* and *surveying the educational quality* (*log book for the learning support*, *KES-R-E*) in the Piramide kindergartens. The corresponding data in the other two treatments were collected in the FaBi project and were made available for analysis in the Piramide project.

In March 2012, one learning support situation in mathematics and/or literacy was recorded on video in each of the four kindergartens. The teachers were asked to design a learning support situation in the domain of mathematics and/or literacy as they normally would. There were no specific subject requirements; only the duration of the learning support was set at a maximum of one hour. A short training session was given to the student assistant who was responsible for the recording the session on video, and a camera script was drawn up. There are a total of 14 videos for the evaluation of the *teacher-child interaction*. One participating kindergarten did not allow the learning support situation to be recorded on video. The process quality of the learning support situation of this institution was observed and assessed on site in July 2012 by a trained professional.

At the same time as the video recording, the *educational quality* of each kindergarten was surveyed by a trained assistant by expanding on the observation instrument *KES-R-E* (Tietze & Rossbach, 2010) in the kindergartens.

The *learning support log books* were also distributed to the schools in March so that the daily learning support sessions could be recorded over the term of the project. A total of twenty learning support log books were completed: four of them on five consecutive days, and the exact date - except for the week that was recorded on video (beginning of the documentation) - was chosen by the teachers themselves. All the teachers who are tasked with supporting preschool children were asked to keep such a log book.

A survey instrument for recording the implementation of the Piramide approach as well as the contextual conditions of the transition and cooperation was *developed* and tested in the project; at the same time, the parents of the participating preschool children were asked to provide information regarding their socio-economic background. Beginning in May, 2012, the questionnaires including a stamped return envelope were distributed to the teachers. By the end of the kindergarten year (June/July, 2012) 68% of the questionnaires had been completed and returned. At the teacher level, all data were also collected in the control group.

2.1.7 Treatments

The domain-specific development of the children at the Piramide schools is compared with the domain-specific learning support of the children in the following treatments:

- course-based oriented approach: “letter land & number land approach” (in short: course-based):

The programs “Komm mit ins Buchstabenland” (“Come to Letter Land”) (Friedrich & Galgóczy, 2008a) and “Komm mit ins Zahlenland” (“Come to Number Land”) (Friedrich & Galgóczy, 2008b) were selected for the “course-based orientation” treatment. These widely used programs have become accepted practices; yet they are criticized by didactics experts (Gasteiger, 2010, S. 79). The training courses were carried out by the “Institute for Preschool Learning” (Waldkirch), which commercially markets these programs. A characteristic of both programs is that they are designed as consecutive learning units that proceed according to a predetermined plan; each of these units focuses on a number or a letter. They feature detailed instructions in the form of lesson plans on how to use them in the learning support units as well as stories, songs, numbers and letters dolls and materials.

- learning-path oriented approach “Kindergarten der Zukunft” (KIDZ) (in short: learning-path):

Based on the KiDZ approach, the learning-path support was implemented by academic staff members who were previously involved in the KIDZ project (extensive description in Stiftung Bildungspakt Bayern, 2007). A characteristic of the KiDZ approach is that the domain-specific learning support is integrated into everyday life and that there are specific offers as well as play and learning environments in which the teacher takes an active role (Kluczniok, Rossbach & Large, 2010). Educational games and topic-related role-playing games (e.g., on restaurant, post office) are used.

- no domain-specific learning support of “control group” (in short: control group):

The children in the control group do not receive special domain-specific support from their teachers. Based on their own statements, they do not work according to a certain concept on domain-specific learning.

2.1.8 Findings from the baseline surveys

The first phase of the Piramide project centers on the evaluation of the baseline surveys. The evaluation focuses on checking whether there are significant differences between the groups in the relevant variables already at the beginning of the learning support. Further analyses comparing the three treatments (excluding the Piramide approach) can be found in Donie, Kammermeyer and Roux (submitted). This is particularly important with the Piramide approach, as it was not possible to allocate schools to this approach by chance, as opposed to the other two treatments and the control group. Rather, it can be assumed that children in kindergartens that implement the Piramide approach differ from the children in other day-care centers for several reasons: They go to schools that probably have particularly dedicated and innovative teachers who have decided to use an approach that is still relatively unknown in Germany. This can result in the fact that a special group of parents (perhaps with particular academic backgrounds) decides to send their children to these day

care centers. The children may also differ from children in other centers because they will usually have benefited from the support of a particular pedagogical approach for a period of two years when their last year in kindergarten starts.

- the domain of literacy: Phonological awareness

Phonological awareness is the key predictor of school success in reading and writing. Table 1 shows the average values, standard deviations, and sample sizes of the random sample for phonological awareness, which was recorded with the corresponding scale of the instrument "wortgewandt" ("eloquent") by Berweger and Moser (2007). A maximum of 58 points can be reached; the average of the total scale is M = 22.7, and the standard deviation is SD = 8.819.

Treatment	M	SD	N
Piramide	25.2	8.82	95
Course-based	21.3	8.78	100
Learning-path	22.0	8.07	114
Control group	22.7	9.40	87

Table 1: Descriptive findings on "Phonological awareness" with t_1

Figure 1 shows the comparison of the treatments in a bar graph. The single-factor analysis of variance for independent samples shows that there are statistically significant differences among the four groups ($F = 3.56$; $p < .05$). Post-hoc Tukey comparisons reveal that these differences exist both between the Piramide approach and the course-based approach (MD = -3.83, $p < .05$) and between the Piramide approach and the learning-path approach (MD = 3.15, $p < .05$). However, no differences with the control group could be established.

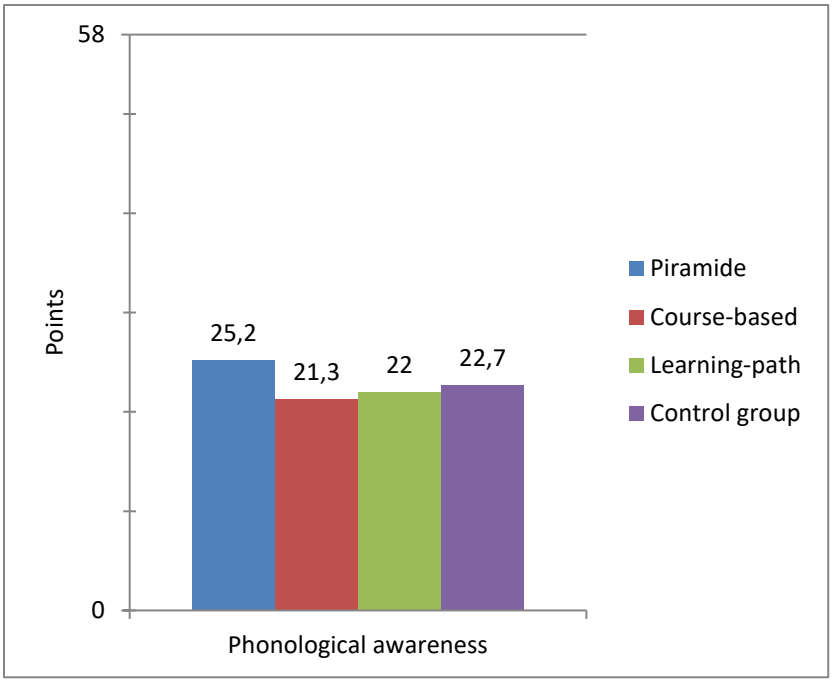

Fig. 1: Comparison of the four treatments for "phonological awareness" with t_1

- the domain of literacy: knowledge of letters/ first reading

In addition to phonological awareness, the knowledge of letters and first reading is an additional central predictor, even if it is only half as important, for success in school for reading and writing. The scale was also measured with the instrument "wortgewandt" ("eloquent") by Berweger and Moser (2007). Similar to the previous point, Table 2 shows the results of the baseline survey in the four treatments. The average of the total scale is M = 6.47, standard deviation SD = 9.99, with a maximum of 66 points.

Treatment	M	SD	N
Piramide	9.9	12.82	85
Course-based	4.5	8.20	100
Learning-path	5.5	8.21	114
Control group	6.8	10.11	87

Table 2: Descriptive findings on "spelling skills" with t_1

The single-factor analysis of variance also shows for this scale statistically significant differences among the four treatments ($F = 5.22$; $p < .05$). The post-hoc Tukey comparisons also show that these differences are attributed to those between the Piramide approach and the course-based approach (MD = -5.42, $p < .05$) and between the Piramide approach and the learning-path approach (MD =

4.40, p <.05) (see Figure 2). In this case as well, no differences with the control group could be established.

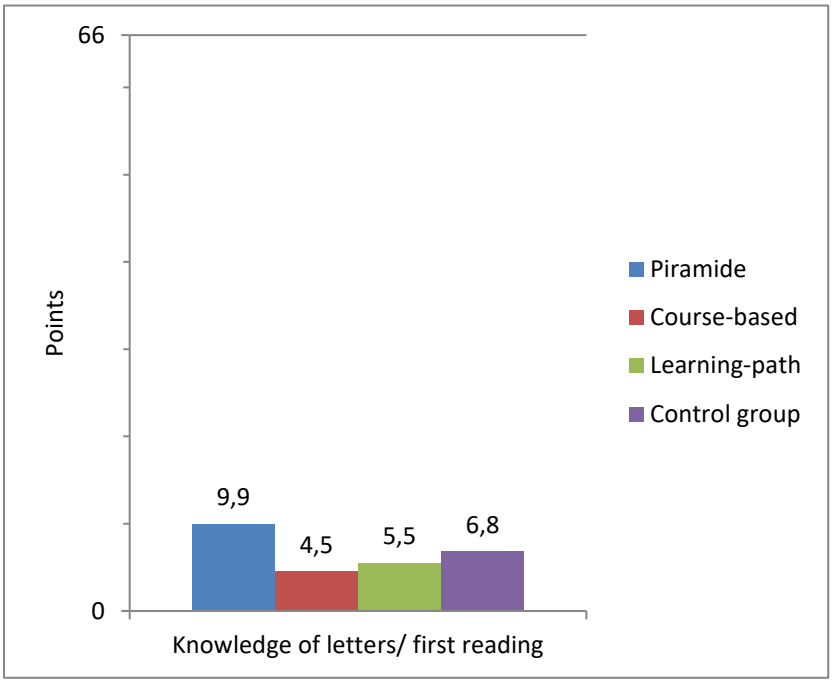

Fig. 2: Comparison of the four treatments for "knowledge of letters/ first reading" with t_1

- the domain of mathematics: numerical/math skills

The domain-specific learning support focuses on both literacy and mathematics. The current research in this area also emphasizes that focusing on mathematic skills early enough can be a good predictor for school success in mathematics. Table 3 shows the baseline results for the four treatments as measured with the scale "zahlenstark" ("strong in numbers") by Moser and Berweger (2007). The average of the total scale is M = 56.66, standard deviation SD = 27.31, and the children were able to reach a maximum of 120 points in this test.

Treatment	t1		
	M	SD	N
Piramide	46.7	18.66	95
Course-based	42.5	17.81	100
Learning-path	43.4	15.58	114
Control group	47.5	19.09	87

Table 3: Descriptive findings on "numerical/math skills" with t_1

Again, a single-factor analysis of variance was also conducted. Contrary to the literacy domain, no significant differences between the four groups could be established (F= 1.862; p > .05) (see Figure 3).

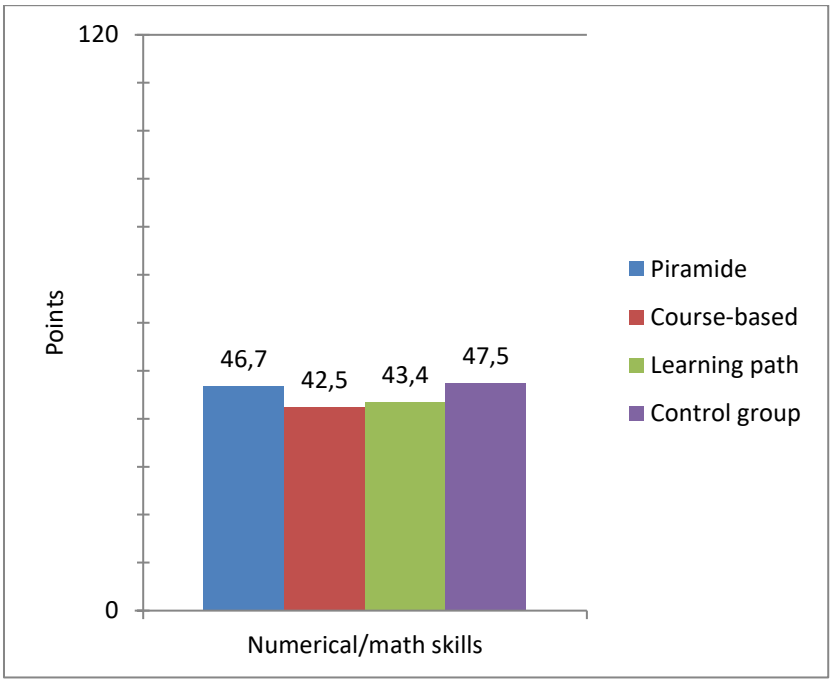

Fig. 3: Comparison of the four treatments for "numerical/math skills" with t_1

- domain-specific joy of learning

The overall average of the joy of learning in "literacy acquisition" across all groups is (on a scale of 1 = "do not like it at all" to 4 = "like it very much") M = 2.95 with a standard deviation of SD = .75. The overall average of the joy of learning in the "mathematics" domain is M = 3.1 (SD = .63). Table 4 below shows the baseline results in the four treatments.

Treatment	Literacy			Mathematics		
	M	SD	N	M	SD	N
Piramide	3.1	.73	95	3.2	.65	95
Course-based	2.9	.72	100	3.0	.65	100
Learning-path	2.8	.76	114	3.0	.62	114
Control group	3.1	.73	87	3.3	.55	87

Table 4: Descriptive findings on "domain-specific joy of learning" with t_1

The single-factor analysis of variance shows that there are statistically significant differences among the four groups in both joy of learning items (Joy of learning in literacy: F = 4.662; p < .01; Joy of learning in mathematics: F = 4.202; p < .01). The post-hoc Tukey comparisons show differences in the

"joy of learning in literacy" domain between the learning-path approach and the control group (MD = -.35, p <.01) and between the Piramide approach and the learning-path approach (MD = .28, p <.05). In the "joy of learning in mathematics" domain, the differences are based merely on those between the learning-path approach and the control group (MD = -.29; p < .01). There are no differences with the control group, in which - incidentally - the highest average values appear (see Figure 4).

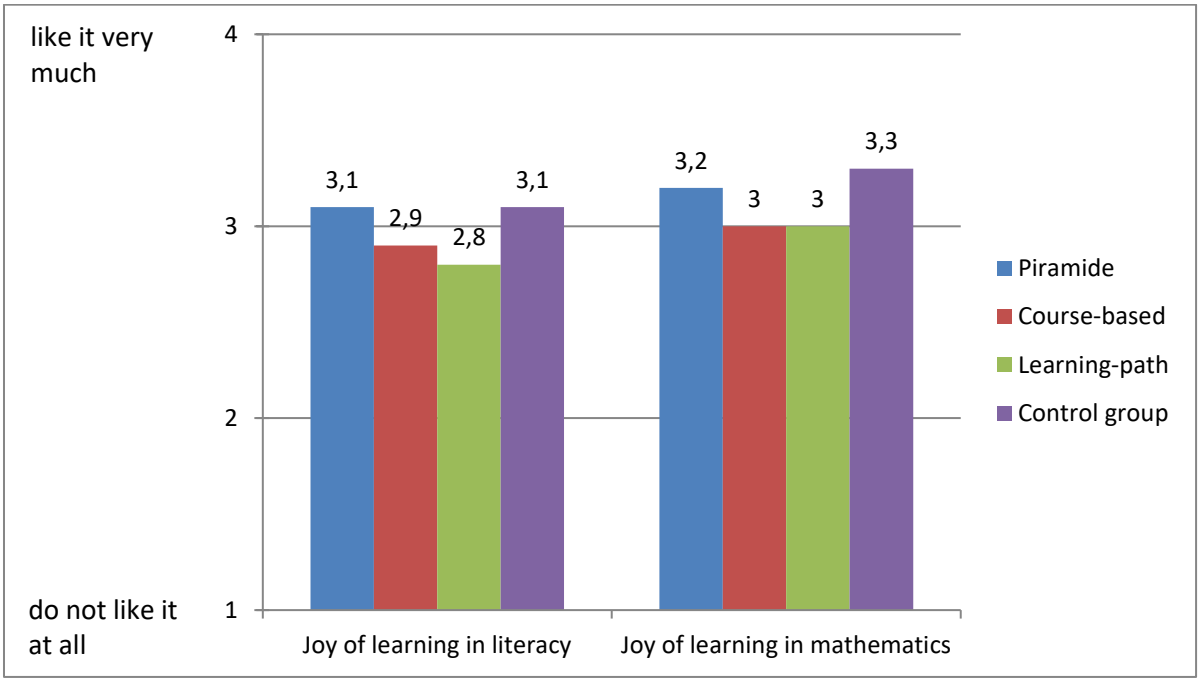

Fig. 4: Comparison of the four treatments "joy of learning in literacy" and "joy of learning in mathematics" with t_1

- domain-specific self-concept

The overall average of the domain-specific self-concept in "literacy acquisition" across all groups is (on a scale of 1 = not very good to 4 = very good) M = 3.0 (SD = .74). The overall average of the domain-specific self-concept in "mathematics" is M = 3.3 (SD = .55).

Treatment	Literacy			Mathematics		
	M	SD	N	M	SD	N
Piramide	3.0	.63	95	3.4	.53	95
Course-based	3.0	.63	100	3.3	.49	100
Learning-path	2.7	.79	114	3.2	.56	114
Control group	3.1	.82	87	3.5	.57	87

Table 5: Descriptive findings on domain-specific self-concept with t_1

The single-factor analysis of variance shows that there are statistically significant differences among the four groups in both items (self-concept in literacy: F = 5.354; p < .01); self-concept in mathematics: F = 4.6; p < .01). The post-hoc Tukey comparisons show that in the "self-concept in literacy" domain these differences are due to those between the course-based approach and the learning-path approach (MD = -.27, p < .05) and between the learning-path approach and the control group (MD = .397, p <.01). In the "self-concept in mathematics" domain, the differences are again based merely on those between the learning-path approach and the control group (MD = -.27; p < .01) (see Figure 5). No differences with the control group are shown here.

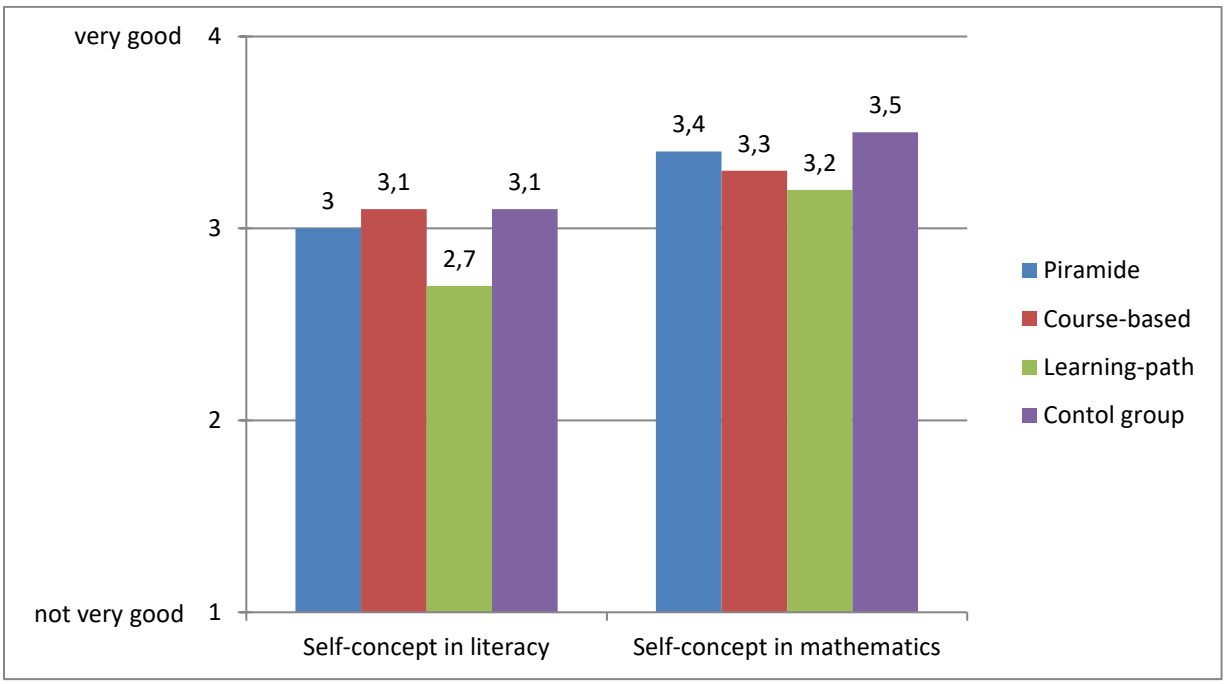

Fig. 5: Comparison of the four treatments for "self-concept in literacy" and "self-concept in mathematics" with t_1

As possible differences between the treatments may also result because the children differ according to other variables and thus the effects would not be caused by the different types of support, several control variables were recorded, such as intelligence, vocabulary and the socio-economic status of the children.

- covariate of intelligence

While it can be assumed that due to the random allocation, the children do not differ in the learning-path oriented approach, in the course-based oriented approach and in the control group. It could be quite possible, however, that children with higher levels of intelligence attend Piramide kindergartens, as parents of such children may select a day-care center with a special pedagogical approach.

Table 6 shows the intelligence as measured by the Colored Progressive Matrices (CPM) by Bulheller and Häcker (2010) in percentile ranks in the four treatments.

Treatment	M	SD	N
Piramide	60.8	28.21	95
Course-based	54.0	27.12	98
Learning-path	53.7	26.50	114
Control group	59.0	27.26	87

Table 6: Descriptive findings "CPM (percentile)" with t_1

The single-factor analysis of variance shows that there are no statistically significant differences among the four groups ($F = 1.713$; $p < .05$) (see Figure 6).

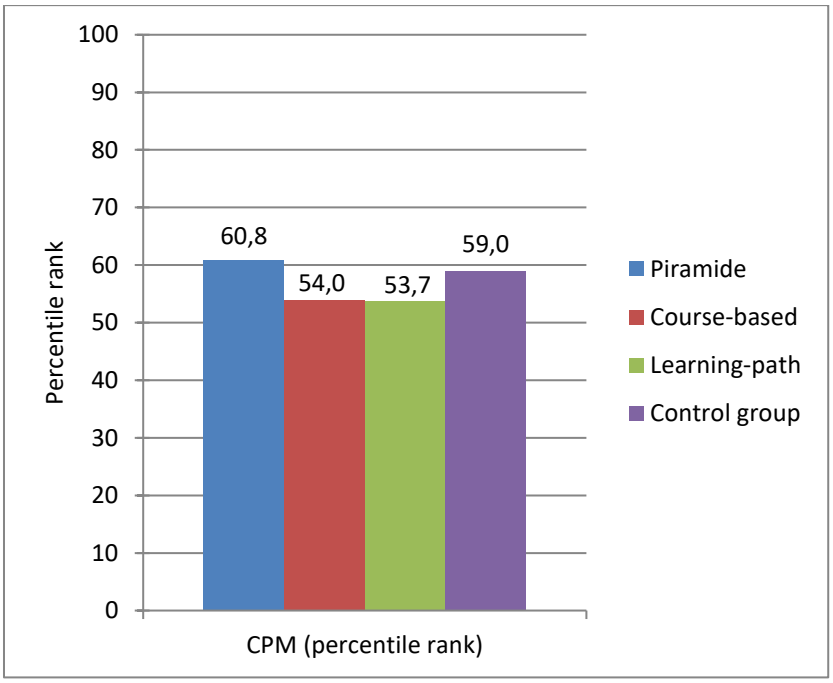

Fig. 6: Comparison of the four treatments "CPM"

- covariate of vocabulary

Even if the children do not differ in terms of intelligence in the treatments, it could be that they differ in vocabulary and attend visit Piramide kindergartens mainly because parents with an academic background, for example, read to their children a lot. Vocabulary was measured with the instrument "wortgewandt" ("eloquent") by Moser and Berweger (2007), where a maximum of 74 points could be attained in this test. Table 7 shows the descriptive results in the four treatments at the time of the first measurement.

Treatment	M	SD	N
Piramide	48.7	11.83	95
Course-based	47.7	14.61	100
Learning-path	50.5	10.57	114
Control group	50.8	14.56	87

Table 7: Descriptive findings on "vocabulary" with t_1

The statistical analysis with a t-test for independent random samples shows that no significant differences between the treatments could be established (F= 1.337; p > .05) (see Figure 7).

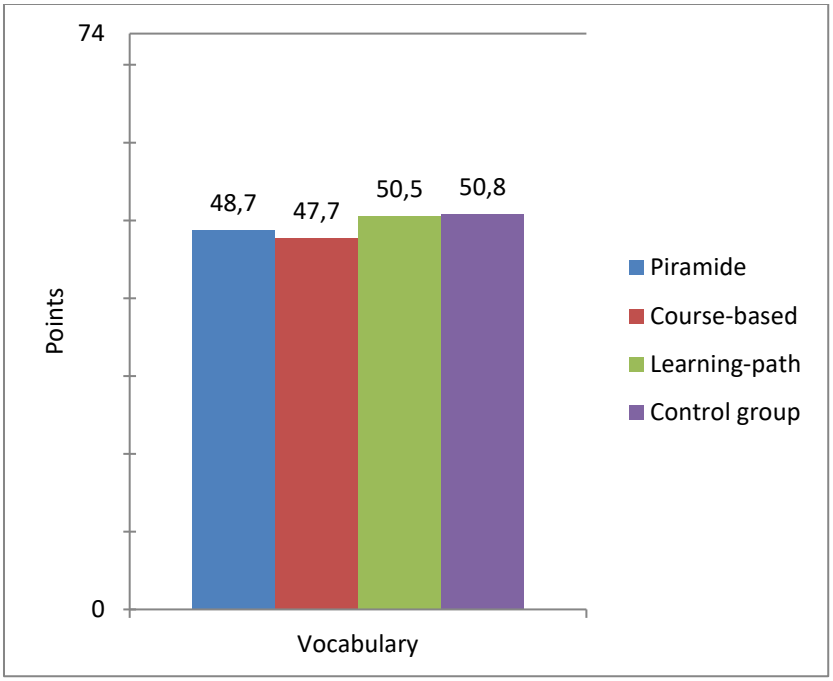

Fig. 7: Comparison of the four treatments for "vocabulary" with t_1

- covariate of socio-economic background

The children may differ in the three treatments in terms of their socio-economic background. This could, in part, explain any possible differences in the development of their skills. It is quite possible that a new pedagogical approach in Germany such as Piramide is mainly selected by a very selective group of parents characterized by a high socio-economic status. In order to take these differences into consideration, the parents were asked provide information about their socio-economic status in a questionnaire. Among the four treatments there are no statistically significant differences either in terms of the educational level of the mother or with regard to the educational level of the father (see also the analysis of the FaBi project by Donie, Kammermeyer & Roux, 2013, p. 313).

2.1.9 Summary of the findings

Table 8 shows a summary of the results of the baseline calculations. The findings show that children in day-care centers that apply the Piramide approach demonstrate significantly better literacy skills (phonological awareness and knowledge of letters) at the start of their last year in kindergarten compared to children in day-care centers that work with the other two domain-specific learning support approaches ("*course-based* orientation" and "*learning-path* orientation") and in the day-care centers that are part of the control group. No significant differences in the mathematical skills of children can be found between the four treatments. In terms of the non-cognitive domain-specific criteria "joy of learning" and "self-concept" there was only one significant difference: The children in the Piramide treatment begin their last year of kindergarten with a significantly increased joy of learning in mathematics compared with children in the learning-path oriented treatment. The three treatment groups and the control group did not differ significantly with regard to "intelligence" and "vocabulary".

		t_1			Difference btw. the treatments			Individual comparison
		M	**SD**	**Min-Max**	**F**	**P**	**N**	
Cognitive criteria								
Phonological awareness		25.2	8.8	7 – 54	3.56	<.05	396	**PI** > CB; **PI** > LP
Knowledge of letters/ first reading		9.9	12.8	0 – 66	5.22	<.05	386	**PI** > CB; **PI** > LP
Numerical/math skills		46.7	18.7	14 – 95	1.86	>.05	396	---
Non-cognitive criteria								
Joy of learning	Literacy	2.95	.75	1 – 4	4.662	<.01	396	CG > LP
	Mathematics	3.10	.63	1 – 4	4.202	<.01	396	CG > LP **PI** > LP
Self-concept	Literacy	2.96	.74	1 – 4	5.354	<.01	396	CG > LP
	Mathematics	3.31	.55	1 – 4	4.6	<.01	396	CB > LP; CG > LP
Covariates								
Intelligence		56.7	27.31	1 – 100	1.713	>.05	396	---
Vocabulary		48.7	11.8	18 – 66	1.337	>.05	394	---

Table 8: Summary of descriptive findings – Baseline (**PI= Piramide**; CB= course-based; LP= learning-path; CG= control group).

Figure 8 shows the findings in comparison. For this purpose, the results of the various test procedures are scaled down to a common scale with the z-standardization (M = 0, SD = 1). The significantly higher average of children in the Piramide approach in the areas of “phonological awareness” and “knowledge of letters” is very impressive.

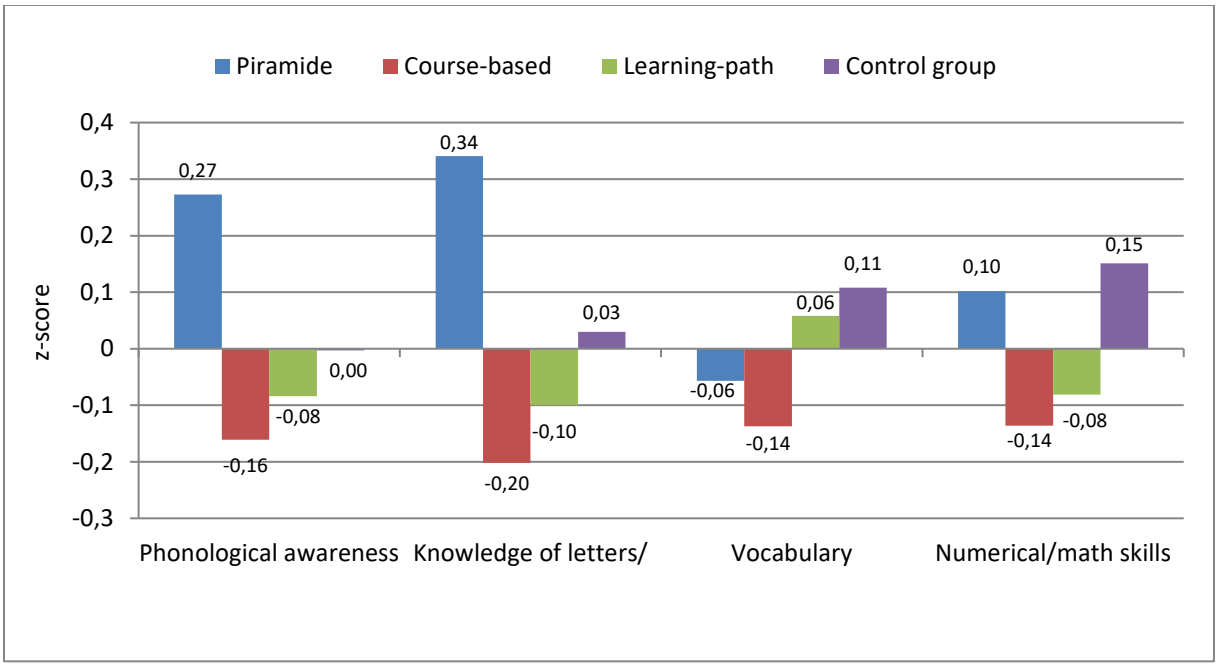

Fig. 8: Findings in comparison (z-standardized)

The main results presented of the first phase of the project are of major importance for answering the main question of the study, i.e., in which treatment do children demonstrate the best development (see Sec. 2.1.5). Due to the significant differences in pre-testing in the Piramide approach, the skill levels at the beginning of the last year in kindergarten must be taken into account as a covariate in the analysis.

On the one hand, the significant differences are not surprising, as the schools were not randomly assigned to implement the treatment, as is the case with the other two treatments and the control group. We can certainly say that children in the Piramide treatment are quite a special group of children. However, this distinction is not of a general nature, as there are no differences in their mathematical skills nor are any in their vocabulary and level of intelligence. On the other hand, it is quite surprising to see significant differences in “literacy” and not in “mathematics” and “vocabulary” even though the Piramide approach also focuses on these domains. Indeed, a review of the Piramide project themes shows that four out of twelve topics are directly related to mathematics (space, color and form, counting, and size). In addition, the relevant vocabulary for each topic in the Piramide projects is explicitly promoted.

In the second phase of the project we will find out whether the children receiving support through the Piramide approach maintain their head start in literacy skills or are able to increase their lead and also whether they perform better than children who are being supported in the other groups. As surprisingly few Piramide-specific elements were noticed during the visits to the certified Piramide schools, doubts arose concerning the hypothesis of the advantages of the support provided by the Piramide approach. Instead, it was found that the most important variable was the non-program-related quality of support, notably the educational process quality, which is reflected in the quality of teacher-child interaction. This process quality was recorded in the first phase of the project, but it will not be evaluated until the second phase.

2.2 Statement on the most important figures in the project

The project was funded for a total of two years with a total amount of **92,896.66 euros**;[2] Table 9 shows an actual-target comparison.

	Actual	Target
Human resources	86,268.12 euros	87,410.00 euros
Material resources	2,847.57 euros	2,751.00 euros
Travel expenses	3,780.97 euros	6,250.00 euros
Total	**92,896.66 euros**	96,411.00 euros

- 86,268.12 euros für human resources (one position for a research associate at 65% of Level 13 of the Collective Bargaining Agreement for German Civil Servants (TV-L 13) and one student assistant position)
- 2,847.57 euros for material resources and
- 3,780.97 euros for travel expenses.

2.3 Statement on the necessity and adequacy of the work performed

It was necessary to conduct each step of the work described here. Any adjustments or additions to the work have been presented in this report.

2.4 Statement on the expected benefits, in particular the usability of the findings as they relate to the updated application plan

The publication of the project results enhances the ongoing debate on education in kindergarten, as support for aligning education processes, especially in mathematics and literacy, continues to be an

[2] See Report on expenditures of funding

important challenge for kindergartens and primary schools. Thus far, little empirical evidence has been provided on how these education domains can be best promoted.

The findings in the video analyses can be used for training and continuing education programs for teachers. In the second phase of the project (see project proposal), we plan to identify the video clips of the successful learning support sessions, list key quality dimensions for them (e.g., feedback, concept development, ask open questions), and look at the subsequent phases of support in which the 4-step method (ODBD) can be used. The successful learning support sessions will be transcribed, and they will be able to be used in publications to substantiate the quality of interaction.

2.5 Statement on the multiplying effects on other projects in this field based on the progress of this project

Although contact to the aforementioned researchers Bingham, Kwon and Hyun (2012) at Georgia State University did not materialize, we were able to obtain the final report on their research from Cito Germany.

In this report, they comment on the efficiency of the Piramide approach in the United States. After the Piramide approach was implemented for two years, the process quality in the Piramide approach was analyzed compared to control groups and the effect on children's development. This study shares a number of similarities with our present Piramide project. As a result of this investigation it can be said that although the teachers using the Piramide approach had higher values in the various indicators for process quality compared to the control group (especially in teachers' support of emotional development and in classroom design of learning environments), this did not lead to different child outcomes on the measures of language, cognitive or social skills in the first year. However, in the second year the children in the Piramide program demonstrated differences in their language skills. For the present study, the authors' conclusions appear to be particularly significant: Although the study shows some advantages of the Piramide approach compared to the usual educational approach, it is evident that these are not necessarily visible during the study. Since it may well be that these benefits come to light only at a later date, the authors consider longitudinal studies necessary to analyze the long-term effects.

The highly "mega-study" by Hattie (2009; also see Hattie, Beywl & Zierer, 2013), which has been receiving considerable attention in the German educational research, provides evidence that supports the study's main hypothesis (which will checked in the subsequent proposal) that the educational quality in kindergarten and, in this particular case, the specific quality of pedagogue-child interaction is more important than the learning support approach. In this survey of over 60,000 empirical studies and approx. 245 million pupils Hattie draws on an unprecedented database to investigate what is

proven to be effective. Hattie (2009) comes to the conclusion that the characteristics of the quality, and not the methods, structures and frameworks, are crucial for learning processes. The quality of support (or cognitive activation) is one of the factors that the Hattie study identifies as particularly effective. The goal should be in providing challenging, thought-provoking questions, rather than mere questions about facts. The Piramide approach with its “4 steps” of orientation – demonstration – broadening – deepening offers a methodical tool for ensuring a central element of the process quality.

2.6 Statement on the publication of the findings

At present, no findings have been published yet. An article is being prepared for publication in the journal “Frühe Bildung”. It will be closely aligned with the contribution that has already been submitted entitled “Förderung schriftsprachlicher und mathematischer Kompetenzen im Vorschulalter – Ergebnisse aus dem DFG-Projekt FaBi” (“Supporting literacy and mathematical skills of preschool children - Results from the DFG project FaBi”), which appeared in the special issue on “Förderkonzepte” (“Support Concepts”) in the journal “Empirische Pädagogik” (“Empirical Pedagogy”) published in the Fall of 2013. The published findings featuring comparisons of the different support approaches are enhanced by additional comparisons with the Piramide approach.

The project as well as the relevant subprojects (design) for the planned doctoral dissertation by Ms. Verena Kathmann (project staff member from 2010 to 2012) was already presented as a poster presentation at two conferences (Grundschulforschungstagung in September, 2010 in Weingarten; the 2011 AEPF Conference in Bamberg). At the conference in Weingarten, the project poster received a prize for the best posters (2nd place).

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