Teachers' development of professional knowledge through action research and the facilitation of this by teacher educators

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Abstract

This article describes the design and results of a descriptive and explorative case study into the development of professional knowledge by teachers through action research and the facilitation of this by teacher educators. The theoretical framework of the study links the Anglo-Saxon Action Research tradition and the German 'Allgemeine Didaktik'. It distinguishes three domains of knowledge: *ideological*, the domain of educational norms, values and objectives; *empirical*, the domain of connections between phenomena in educational reality; and *technological*, the domain of educational methods, techniques and strategies. Seven groups of teachers at six schools participated in the study. Teacher educators facilitated them over a period of two years. The findings indicate that left to themselves, teachers tended to develop knowledge mainly in the technological domain and rarely in the empirical and ideological domains of knowledge. The findings also show, however, that the more attention facilitators paid to all three domains of knowledge, the more teachers started to develop knowledge in those domains.
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1. Introduction

The case study, described in this article, concerns seven groups of teachers at six schools. These groups of teachers took part in a program in which they learned to gain professional knowledge through action research (Ponte, 2002a, b). They were facilitated by four teacher educators from two teacher education institutions over two years.

The researchers were not involved in the facilitation of the teachers; however, one of the researchers supported the facilitators.

Professional knowledge through action research was seen in the case study as insights and understanding that teachers develop themselves. These insights can be distinguished from the general knowledge (developed by others) that teachers also use in practicing their profession. Action research is conceived as a strategy teachers can use to make their work more professional. To do that they use research methods of the social sciences to reflect on their own practice and they use their insight and understanding gained in this

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way to systematically improve their practice. The action research in the program was based on four key assumptions (Ponte, 2002a, b):

- Action research is geared to teachers' own practice and the situation in which they are practicing.
- In action research teachers engage in reflection based on information they have systematically gathered themselves.

Action research is carried out through dialogue with colleagues within and outside the school.

In action research students (or other target groups of teachers) are used as an important source of information.

The action research strategy used in the program was mainly based on the model of Elliott (1991). It consists of the following main tasks for the teachers. First, teachers worked with a plan of five steps (consisting of the formulation of a general idea; the exploration of their general idea; drawing up of a general plan; planning, implementation and evaluation of concrete actions for improvement; and writing up of a case study on the teachers' own action research). Second, teachers wrote up logbooks in order to record and evaluate their action research and to plan how they would follow it up (see also the section about research method). Third, teachers functioned as critical friends who helped each other to reflect on what they were doing and why, mainly by asking questions. To these three common action research tasks a fourth task was added (which is seen as the professional standard for teachers doing action research): Teachers ask themselves questions with regard to a number of aspects of the action research process. The aspects are (Ponte, 2002a, b; see also Carr & Kemmis, 1986/1997; Elliott, 1991; Zeichner & Noffke, 2001):

- *Vision*: What are my underlying assumptions and visions and how can they be placed within the context of those of others (the school, the authorities, academia, etc.)?
- *Evidence*: How do I know whether my assumptions about a situation (or my actions in relation to pupils, colleagues or others) are

correct and how do I know whether my actions in that situation have had the outcome I intended?
- *Interpretation & explanation*: What do the facts I have gathered tell me about the situation to be changed (or changes I need to make in my behavior toward pupils, colleagues or others) and how are they connected?
- *Dialogue*: How do I involve pupils, colleagues or others in planning, implementing and evaluating my activities?
- *Improvement*: Why do I think that a change is also an improvement and for whom is the change an improvement?
- *Ethics*: Is what I am doing ethical and, if not, what can I do about that?

The idea that teachers can improve their own practice through action research is inspired by the idea that the development and use of professional knowledge interact as action research is carried out. Development and use of this knowledge are aspects of a cyclical process that teachers take responsibility for themselves: they apply professional knowledge and based on that application they develop new knowledge, which they then apply again, and so on. A distinction can be made in this context between the 'knowledge agenda' of academics and the 'knowledge agenda' of teachers (Eraut, 1994; Fenstermacher, 1994; Hoyle & John, 1995; Sachs, 2003). Academics attempt to develop general knowledge about certain aspects of reality, whereas teachers aim to develop knowledge about how to act in specific, complex and unpredictable situations. This view, according to Elliott (1991), sees professional knowledge as consisting of *practical wisdom* or insight and understanding which enables teachers to achieve educational and moral objectives in practice.

This view of action research and professional knowledge fits into a long but still contemporary tradition both within and outside education. Prime movers of this—mainly Anglo-Saxon—tradition include Dewey (1929/1984),[1] Lewin (1946), Stenhouse (1975), Carr and Kemmis (1986/1997),

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[1] Refers to both the first and last edition as relevant in terms of content.

Grundy (1987/1995), Elliott (1991) and Tabachnick and Zeichner (1991). There have been a great many publications about action research over the past thirty to forty years. It is conspicuous, however, that little if any systematic research has been conducted into the development of professional knowledge through action research carried out by teachers or into the role teacher educators can play in the facilitation of this process. The study described in this paper aims to contribute to filling that gap.

The general problem defined in the article concerns how and the extent to which teachers develop professional knowledge through action research and how and the extent to which the facilitation they receive affects this. This question is developed in more detail in the next section based on a theoretical framework (Ponte, 2002a), that fits into the concept of 'praxis' from the literature on the development of professional knowledge (Grundy, 1987/1995; Carr & Kemmis, 1986/1997; Westbury, Hopmann, & Riquarts, 2000). This concept is further developed here using, among others, Riedel's (1977) model for the *Allgemeine Didaktik und unterrichtliche Praxis*. His model concerns pedagogy as branch of educational science. However, it turns out that Riedel's model can also be used to analyze the development of professional knowledge by teachers through action research. As his model—in line with the German 'Didaktik' tradition—focuses on teacher education, it turns out that it can also be used to analyze the facilitation of action research.

2. Theoretical framework

2.1. Development of professional knowledge through praxis

Riedel (1977) defines professional knowledge as the knowledge of teachers who are acting with a purpose and taking responsibility for their own actions. Teachers develop this knowledge through praxis. Professional knowledge based on praxis can be distinguished from general knowledge based on theory (modelled predictions of educa-

tional reality) and 'techne' (potential skills, techniques and strategies). Knowledge based on 'techne' and theory is not the insight and understanding of the practicing teacher, but knowledge itself, knowledge that the teacher could have mastered before practicing at all.

Educational literature rarely distinguishes between theory and 'techne' (see e.g. Kessels & Korthagen, 1996). Riedel maintains that this is because both are forms of systematic knowledge, that is knowledge about regularities. Theory is concerned with knowledge about how phenomena are related in certain situations, for example: *Research shows that the safer students feel the more progress they generally make in learning to discuss things with each other*). 'Techne' is concerned with knowledge about what could be done in certain situations (for example: *Different measures are taken based on research that are generally effective in creating a safe learning environment*). It is important for education that both 'techne' and praxis are intended to exert a direct influence on practice. 'Techne', however, is concerned with general knowledge about the exercise of influence without the need to be responsible for the objective behind it, whereas this responsibility is the key to praxis (for instance: *It is important to me that students in my class feel safe and they have a right to feel safe. So I ask myself what I have done in concrete terms to create a safe climate. Did what I did have the desired effect?*). Praxis, therefore, is concerned with achieving goals that the professional takes responsibility for. This means that professional knowledge via praxis is developed through purposeful intervention in the reality of others. After all teachers are trying to teach their students something. 'Trying to teach them something' is connected with choices about what must be taught and how (for instance: *It is important that students learn to discuss and it is important that they do that by listening to each others' arguments and questioning them*). Theory and 'techne' can be used when making these choices but their use in itself does not constitute praxis. Praxis only arises in a situation—limited in time and space—in which practitioners are acting with a purpose and taking responsibility for their own actions (see Fenster-

macher, 1994; Kessels & Korthagen, 1996; Sachs, 2003). Insight into purposeful and responsible practice arises through interaction between the different actors and so it cannot simply be transferred by telling or explaining. In other words: professional knowledge arises in a situation in which teachers, in interaction with their students (or colleagues) try to realize certain educational and moral norms and values. Teachers can use general knowledge as a source of ideas for their teaching activities, but this knowledge cannot prescribe exactly how they should act in concrete situations. Tom & Valli (1990, p.380) argue: "Academic research can be a source of insight, a way of transforming how the practitioner perceives teaching and other educational phenomena. In the end, the decision on which knowledge to use and how to relate this knowledge to practice is seen as being a decision rightfully made by the practitioner."

Riedel also connects the concept of 'praxis' described above to the practice of facilitators who 'teach teachers about teaching'. Facilitators cannot transfer professional knowledge about teaching but they can help teachers to develop that knowledge through praxis. They realize a situation—limited in time and space—and within that situation they realize their help in interaction with the teachers they are facilitating. Since interaction by definition implies a certain reciprocity, we have therefore assumed a close relation between the way teachers develop professional knowledge through their action research and the way facilitators help them to do this.

2.2. Domains and levels of professional knowledge

The question that presents itself now is what insights teachers should develop and how they should do that, when professional knowledge is defined as the knowledge of a teacher who is acting with a purpose and taking responsibility for his or her own actions. To answer this question we introduce (1) three domains in which teachers develop knowledge and (2) two levels to which their knowledge can relate.

2.2.1. Domains of knowledge

Riedel (1977) distinguished three domains in which knowledge should be developed for pedagogy as a branch of educational science, namely the ideological, empirical and technological domains of knowledge. By analogy, we have assumed that teachers also develop knowledge in these domains themselves in order to act with a purpose, taking responsibility for their own actions. This knowledge can be defined as follows:

- The ideological domain of knowledge is concerned with insight into their educational and moral norms and values, and into concrete objectives derived from these.
- The empirical domain of knowledge is concerned with insight into the connections between phenomena in their educational reality.
- The technological domain of knowledge is concerned with insight into educational methods, techniques and strategies that they can use.

Riedel developed the domain of knowledge based on the concepts 'manifestations' and 'effects'. Manifestations are aspects of education. They are usually able to be observed directly. For instance, teaching methods used by the teacher can be observed directly. Effects are the influences of the education on the students, which cannot always be observed directly. For instance, how the teacher's actions affect the students' motivation. Motivation cannot be observed directly, it can usually be deduced from the students' behavior. Manifestations and effects can be related to the three domains of knowledge as follows:

- The ideological domain of knowledge is concerned with teachers' understanding of norms and values, and the objectives based on those norms and values that they wish to achieve with their students (in the near future). This means the desired effects of their teaching.
- The empirical domain of knowledge is concerned with teachers' insight into current educational reality. This is about the relationship between actual manifestations and actual effects in relation to their teaching.

- The technological domain of knowledge is concerned with teachers' understanding of methods, techniques and strategies that they plan to use (in the near future) to achieve the objectives they have formulated. This means the desired manifestations of their teaching.

2.2.2. Levels of knowledge

Teachers' 'clients' in action research are the students they teach or colleagues they support as they perform their teaching roles. When teachers develop knowledge about teaching their 'clients' through action research, the content of this knowledge can be defined in concrete terms on the basis of the ideological, empirical and technological domains of knowledge (see Fig. 1). This is what we see as the first level of knowledge. We see knowledge about how this knowledge is developed as the second level of knowledge.

The action research facilitators' 'clients' are not the students, however, but the teachers in the school. It is not their role to teach teachers to improve their teaching (the first level of knowledge in Fig. 1), but to help teachers to develop knowledge in those domains for themselves through action research (the second level of knowledge in Fig. 1). On the second level of knowledge, four actions and skills can be distinguished that are expected of teachers if they are to develop that knowledge, actions and skills that facilitators can help them with. These actions and skills are summarized in Fig. 2 and explained in the section below.

2.3. Actions and skills of teachers at the second level of knowledge

The domains of knowledge are integrated in the concrete professional activities of teachers as praxis. Therefore a distinction can only be made between the ideological, empirical and technological domains of knowledge in a formal sense. Based on the necessary integration of the domains of knowledge, we assume that teachers develop greater insight and understanding the more they (1) devote *proportionate attention* to the three domains of knowledge and (2) continuously *link* the different domains of knowledge. This means

First level of knowledge:

Ideological domain of knowledge	Empirical domain of knowledge	Technological domain of knowledge
Development of insight into moral-ethical choices and the objectives relating to education based on those choices	Development of insight into the relationship between education practice and their influence on the students (or other target groups of teachers)	Development of insight into methods, techniques and strategies that can be used to realise the formulated objectives

Second level of knowledge:

Learning how insight and understanding can be developed in the ideological, empirical and technological domains of knowledge through action research

Fig. 1. Domains of knowledge on two levels.

Dimension:	Categories:	Teachers:		Facilitators:
Domains of knowledge	proportionate	devote proportionate attention to the three domains of knowledge	←→	help teachers to devote proportionate attention to the three domains of knowledge
	link	continuously link the three domains of knowledge	←→	help teachers to continuously link the three domains of knowledge
	freedom of choice	link the objectives of others to their own objectives	←→	help teachers to link the objectives of others to their own objectives
	dealing with knowledge	link their own knowledge to others' knowledge	←→	help teachers to link their own knowledge to others' knowledge

Fig. 2. Teachers' and facilitators actions and skills on the second level of knowledge.

that teachers, developing professional knowledge through action research, know how they can use these two actions (knowledge at the second level) to gain knowledge about how to design their teaching activities (knowledge at the first level). As Fig. 2 shows, facilitators are expected to support them as they learn to master these skills.

Next we assume that teachers engaging in action research will reflect on decisions they take in day-to-day practice. Of course, they are not free to simply do as they like. They are members of a social community, in which others (parents, professional groups, government, academic community) also have expectations regarding education. These expectations (or others' objectives) set the general frameworks, but teachers (consciously or unconsciously) lend their own interpretations to these frameworks. In other words, in principle they always exercise their freedom of choice (see also Eraut, 1994; Hargraeves, 1998). Action research involves making those choices explicit by raising the objectives of others for discussion with a view to defining one's own objectives (Elliott, 1991). This means subjecting the objectives of others to critical discussion based on one's own ideological, empirical and technological insights and under-standing. On this basis we assume that teachers will develop greater insight in the three domains of knowledge the more they exercise their *freedom of*

choice by linking the objectives of others to their own objectives. Facilitators are also expected to support them in this task.

Finally, in carrying out their action research teachers also use general knowledge developed by others. Following Stenhouse (in: Rudduck & Hopkins, 1985, p. 93) we assume that they cannot simply apply that knowledge, however, but they use it as a resource for 'hypothetical procedures teachers could experiment with as a basis for the reflective translation of educational ideas into educational actions'. This assumption means that teachers *deal with the knowledge* of others critically. Based on this we also assume, therefore, that teachers will develop greater insight into the three domains of knowledge the more they raise general knowledge for discussion with a view to formulating their own objectives and insights. As Fig. 2 shows, facilitators are expected to support teachers in these four tasks and we expect that the more they do so, the more teachers will develop insight.

3. Method

3.1. Research questions

In the last section the actions and skills that teachers have to master in order to develop

professional knowledge—actions and skills with which facilitators are able to help them—were broken down into the four categories summarized in Fig. 2 under the terms 'proportionality', 'link', 'freedom of choice' and 'dealing with knowledge'. Using these categories the general research problem could now be broken down into two research questions:

- To what extent and in what way do teachers develop with respect to the categories 'proportionality', 'link', 'freedom of choice' and 'dealing with knowledge'?
- To what extent and in what way do the facilitators have an influence on teachers' development in the categories 'proportionality', 'link', 'freedom of choice' and 'dealing with knowledge'?

The study was designed as a single embedded case study (Yin, 1989). The case study was single because the program for all teachers had the same design. The case study was embedded because the seven groups of teachers with their facilitators were used as separate units for the analysis of the data.

3.2. Context of the study

The study was conducted as part of the ARTE-international project. ARTE stands for Action Research in Teacher Education. The project aimed to study the facilitation of action research within different programs in Britain, The Netherlands, Russia and the USA. Only the Dutch case study with regard to teachers' development of professional knowledge is presented in this paper. The two years of facilitation provided to the Dutch teachers as they were learning to do action research was called 'the ARTE program'.

3.2.1. Participants

A total of 35 teachers were involved at the beginning of the ARTE program. Eleven teachers dropped out and four new teachers joined during the program, so that there were 28 teachers in the ARTE program at the end. The main reasons for teachers dropping out were personal circumstances

or the ups and downs associated with mergers and reorganizations at their schools. The participating teachers formed seven groups at six secondary schools. The ARTE program was offered as a school-based in-service program, in which teachers were asked (individually or in groups) to improve the guidance of pupils in their classroom, in their department or in the school as a whole through action research. They were asked to frame their own questions. Teachers took part on a voluntary basis and did not receive any rewards for doing so in the form of credits or the like, so there was no formal pressure to complete their action research. On average the teachers spent about 200 h on program activities. Three of the schools allowed them time to do this but at the other three schools the teachers did their program activities in their free time.

Each school had a teacher educator who supported the teachers in the small groups. A group of teachers with their facilitator formed a network. Four facilitators from two Teaching Education Institutes took part. The facilitators were also conducting their own action research (supported by one of the researchers) into how they facilitated the teachers in their networks. The four facilitators were also taking part on a voluntary basis and they were given about half a day a week for the activities involved in facilitating their networks.

The teachers who took part in the program had little or no previous experience of action research and the teacher educators had little or no experience with facilitating action research.

3.2.2. The program

The program was based on the assumption that teachers would master action research through praxis (see the theoretical framework) and so they were facilitated in situations—limited in time and space—in which they discussed their practice as they carried out their action research. During the project program the networks met with their facilitator on average seven times a year. In addition to these facilitation meetings at the teachers' own schools, three 1-day meetings were held for all the Dutch teachers together. The teachers also had the opportunity to discuss their

action research with English participants in the ARTE-international project during a three-day workshop in Cambridge (UK) and a visit to one of the English project schools. At these meetings the teachers reported on the progress of their action research and the facilitators always geared their interventions to this. At the beginning of the program—based on the theory on praxis—the following assumptions were formulated:

- The facilitators do no more than provide a general framework for the pupil guidance and then encourage the teachers to develop their own interpretations, solutions and additions to the content.
- The facilitators encourage the teachers to develop their interpretations, solutions and additions by continually translating the teachers' questions and comments about content (on the first level of knowledge, see the theoretical framework) into questions as to how action research can be used to tackle these issues (the second level of knowledge).
- The facilitators create a situation in which they can communicate with teachers about their concrete experiences with action research, or—as we said earlier—a situation in which they can develop insight into their purposeful and responsible practice through interaction with each other.

The project also assumed that facilitators would master the skill of facilitating action research through praxis and that they could therefore be models to the teachers. To this end they were also facilitated in situations—limited in time and space—in which they discussed their practice. They followed a kind of parallel program to the program for the teachers as they carried out their own action research on the facilitation of their school networks. Like the networks, the facilitators and the project leader (one of the researchers) met on average seven times a year. At first their meetings focused on the development of the common framework for running the project program. Once the program for the teachers had started, these meetings became the forum at which facilitators discussed how they facilitated their

networks. At a workshop in Minneapolis (USA), the facilitators had the opportunity to exchange experiences with facilitators who were taking part in the project in Russia, the UK and the USA. Throughout the whole ARTE program, the facilitators worked with various types of facilitation material. This included (1) topic cards with concise information on aspects of action research, such as the plan of activities and the rules for being a critical friend, (2) forms for the concrete planning of action research, and (3) hand-outs summarizing, for instance, how to gather and analyse data and how to write up the case study. Information in the form of short articles on and examples of action research was also used.

3.3. Data-collection

The researchers gathered data at different times in the program using four different instruments: logbooks, fragment analyses, supplementary interviews and documents. The *logbooks* were used throughout the whole program to gather information about the progress of the teachers' action research and the support they were given by the facilitators. Both teachers and facilitators used forms with a number of (open) questions before and after each facilitation meeting[2] (there were teachers' logbooks from 67% of 109 meetings in total; there were facilitators' logbooks from 98% of 109 meetings in total). In each logbook the teachers answered questions such as: What did I contribute to this network meeting in connection with my action research? What did I hope to achieve for myself and what did I actually achieve? How did the facilitator help me and why did that help? The same kinds of questions in terms of content were formulated for teachers and facilitators as far as possible, so that the logbooks could be compared. So the facilitators answered

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[2] The logbook, in which teachers record and evaluate the progress of their action research for their own use and in which they plan what to do next, is an important aspect of action research. The literature shows that most people work with unstructured logbooks (Winter, 1996; O'Hanlon, 1997), but it was decided to structure them for this case study and to allow both teachers and facilitators to use forms containing a number of open questions.

questions such as: What did I do in this meeting and why did I do that? What do I think this achieved for the members of the network and the network as a whole? Which of my interventions were successful and what can I attribute that to?

The facilitators' *fragment analyses* were intended to supplement their logbooks as well as the logbooks of the teachers (there were fragments from 67% of the 109 meetings). To facilitate the fragment analyses all the meetings were recorded on tape. After each meeting the facilitators selected one or more short fragments from the recordings which they wrote out and then analyzed using standardized questions (e.g.: What did I do in this fragment and why did I do that? What do I think this achieved for the members of the network and the network as a whole? Which interventions were successful and what can I attribute that to?) In order to be able to identify important developments in the process, the facilitators were asked to select fragments which in their opinion illustrated (1) a turning point in their thinking or action or that of the teachers, (2) a sudden insight on their part or that of the teachers, (3) their own or teachers' interventions that had a clear impact and/or (4) regularly recurring situations. As can be seen from the above examples, the questions for the fragment analyses of the facilitators matched the questions from the facilitators' and teachers' logbooks in terms of content, making comparison possible here too.

The three *supplementary interviews* with the teachers and the two supplementary interviews with the facilitators were geared to the information available per recording via the logbooks and/or fragment analyses. They were usually asked to clarify something or to provide additional information. All the teachers were also asked what they gained from taking part in the program.

Finally, *documents*—the case studies that teachers wrote up as part of their own action research—were analyzed. The data taken from these documents for the research were teachers' comments on what they gained from taking part in the program. These comments were written at the request of the researchers.

For the sake of reliability and internal validity, the following techniques were used:

- Triangulation of data sources, by (1) gathering information from teachers and facilitators, (2) gathering information at different points in time during the program, and (3) gathering information in both secondary schools and senior secondary vocational schools.
- Triangulation of methods, that is by gathering data from logbooks, fragment analyses, supplementary interviews and documents.

3.4. Data analysis

A large amount of qualitative data was gathered in the study. To make this manageable the data from the logbooks, fragment analyses and supplementary interviews were put into a case-study database. Kwalitan, a computer program (Peters, 1995), was used to divide up the written material into smaller pieces of text. The pieces of text are called 'segments' in the Kwalitan program. There were 6486 segments in total, divided—for pragmatic reasons—into four periods:

- period 1 (September 1997–January 1998);
- period 2 (February 1998–July 1998);
- period 3 (August 1998–April 1999) and
- period 4 (May 1999–July 1999).

The data from the case studies that the teachers wrote as part of their own action research only became available at the end of the program and were analyzed manually.

Codes were then assigned to the segments that were used—following Miles & Huberman (1994)—to summarize the research material. This gave us a systematic method of retrieving the data and a simple way to relate different items of data. Several codes could be assigned to each segment. The codes were derived from:

- The theory (for example: segments in which teachers said something about the actual effects or manifestations could be identified with the code 'evidence').
- The questions in the logbooks and fragment analyses (for example: segments in which teachers answered the question about what they had contributed in their action research could be identified with the code 'contribution').

The codes were adapted and supplemented several times based on the research material to produce 26 codes in the end. The inter-rater agreement was calculated over 3500 codes (of two independent raters) for 1512 segments from networks A and B, periods 1 and 2. The inter-rater correlation was calculated using the Kupper measure (Kupper & Hafner, 1989). The correlation was very high being 0.96 for all codes together.

The later phase of data analysis using the codes was also carried out in several rounds (cf. Yin 1989, pp. 113–115). Each round started with an initial exploratory analysis of data from network A, period 1, followed by analysis of data from networks A and B, periods 1 and 2. These analyses were checked against data from the other networks, periods 1–4, to find out whether there were grounds for additions or modifications. The process was repeated until saturation was reached, that means when no more new insights were obtained. New insights only emerged from the analyses of networks C and D, in periods 3 and 4 (no new insights emerged from networks E, F and G). For that reason only the data from networks A, B, C and D, periods 1 to 4, were used in reaching final conclusions on the research questions $(n = 17)$. Areas of agreement and differences between the networks were compared and summarized with the aid of scores in overview tables.

The researchers' analyses and interpretations were given to an external researcher who checked whether the three criteria for analyzing the data had been complied with (*peer debriefing;* Denzin & Lincoln, 1994). The criteria were: (1) saturation point must have been reached, (2) findings must emerge from more than one source, that is in more than one research instrument and from more than one facilitator and/or teacher and/or network, and (3) the findings described must be clearly identifiable in the material. The conclusions were also given to network facilitators (limited *member checks*; Denzin & Lincoln, 1994). The facilitators were asked whether the results concurred with their findings. The *peer debriefing* resulted in some modification of the results, the *member checks* did not.

4. Findings

Table 1 summarizes the development of the teachers in the categories from Fig. 2, and the attention paid to these categories by the facilitators. This is the researchers' assessment of teachers' knowledge development and attention paid by facilitators based on the evidence provided by the research material (the teachers' own assessment of their development at the end of the program is dealt with later under a separate heading). The table shows the differences between the first and fourth periods, that is the situation in the initial and final periods. The second and third periods turned out to fit consistently into this pattern.

4.1. The teachers' development in the categories

Table 1 shows that at the start of the program many teachers scarcely showed the skills and actions expected of them if at all. This was especially true of networks A and B. No data were found on *dealing with knowledge* in period 1. This category played a role to varying degrees in networks B and D during the course of the program and occasionally in networks A and C. General (others') knowledge, however, was rarely raised for discussion with a view to formulating their own objectives and insights. It was mainly used as a source of directly applicable, practical ideas.

The data on *proportionality* and *link* show that most teachers, left to themselves, focused more on insight into what they planned to do (the technological domain of knowledge), than on insight into what they wanted to help the students to achieve (the ideological domain of knowledge). Nor did the majority of teachers' focus explicitly in the beginning on understanding how they could actually achieve those objectives at a given moment (the empirical domain of knowledge). One can conclude from this that teachers themselves did not usually gear themselves to gaining insight into their current practice and the actual situation in which they were working. Teachers immediately tended to look beyond their own practice, as it were, to what they wanted to do in

Table 1
Teachers' development and attention paid by facilitators by category (as assessed by the researcher from the research material

	Network A		Network B		Network C		Network D	
	Teachers[a]	Facilitator	Teachers[b]	Facilitator	Teachers[c]	Facilitator	Teachers[d]	Facilitator
Proportionality								
1st period	—	—	—	—	±	+	±	±
4th period	±	±	±	±	±	±	+	+
Link								
1st period	—	—	—	—	±	+	±	±
4th period	±	±	±	±	±	±	±	+
Freedom of choice								
1st period	—	±	±	±	±	±	—	±
4th period	±	±	±	±	±	±	+	+
Dealing with knowledge								
1st period	*nk*	—	*nk*	±	*nk*	—	*nk*	±
4th period	—	—	±	±	—	—	±	±

Meaning of the scores: + The phenomenon is found *very often, often, regularly, usually, to a large extent* in the research material. ± The phenomenon is found *occasionally, sometimes, not always* in the research material. —The phenomenon is found *little, rarely, very occasionally, hardly ever or never* in the research material. *nk* Not known.
 [a] $n = 5$.
 [b] $n = 4$.
 [c] $n = 3$.
 [d] $n = 5$.

the near future. One teacher, for example, said: "I want to offer better guidance to help the students work independently". She did not then base her plans on what was actually going on at that point in time in her class (for instance: *What am I doing at the moment to allow students to work independently?, Why is that working/not working?, Which students find it difficult to work independently?, What situations are they having problems with?*), but on what she thought she should do in the near future: "I am going to produce a study scheme for the whole department, a complete program with inspirational teaching material. After that it is a matter of implementing it".

Regarding *freedom of choice* it emerged that during the course of the first year almost all the teachers had formulated personal objectives on which they wanted to work, but that most of them did not do that on their own. Nor, apart from the teachers in network D, did they do that by raising the objectives of others (the school, government)

for discussion. Many teachers initially expressed uncertainty about choosing their own objectives. Carrying out something "thought out by others" was felt to be "safer and less confrontational". These findings were most marked in networks A and B.

4.2. The attention paid to the categories by the facilitators

The data in Table 1 show that the degree of attention paid to the categories by the facilitators largely parallels the teachers' development, especially in period 4. The facilitator of network D, for instance, paid a great deal of attention to *proportionality* and this was matched by high scores for the teachers in this category. The data show that the facilitators usually made a *link* between actual and desired manifestations (what and how). They were less inclined to link actual and desired effects (why). The facilitator of

network C was an exception in period 1 (focused on effects) as was the facilitator of network D in period 4 (focused on effects). It is noticeable that in networks C and D all the teachers eventually came to focus on the link between what, how and why, whether occasionally or on a regular basis, whereas not all the teachers from networks A and B did that. On *freedom of choice* the facilitators focused on choosing individual objectives from the outset, but only facilitator D asked teachers to raise the school's objectives for discussion. Finally, on *dealing with knowledge* it turned out that facilitator B and D did encouraged teachers to make targeted use of general knowledge (in response to concrete questions from teachers as they carried out their action research: *You could take a look at that book on the question you have come up against now*), but they rarely encouraged them to raise this knowledge for discussion with a view to formulating their own insights. The facilitators of network A and C paid little attention to dealing with knowledge. Table 1 shows that the focus of the facilitators and the teachers went through the same development process for this category.

4.3. How the facilitators influenced the teachers' development

The comparison of the data in the teachers' logbooks with the data in the facilitators' logbooks and fragment analyses revealed that teachers probably developed most under the influence of the facilitators. It also emerged that facilitators were initially rather reticent about focused direction (especially facilitators A and B). Their reticence seemed to stem from the idea that teachers "must actually be responsible for their own action research". As they discovered that teachers were not going to take responsibility on their own, they started to be more proactive as the program went on. They did not do that by giving more explanations and instructions beforehand (as they did at the beginning of the program), but mainly by repeatedly asking questions and giving instructions on the spot as the teachers were doing their action research. The next fragment gives an example.

Teacher M: "What is important for me in the end—if students really are working independently with the study scheme—that you can offer them more one-to-one support. I think that would create a different working atmosphere."
Facilitator: "Yes and you are testing out the study scheme. Have you really been working in a less traditional way, did you really have more time for individual students…?"
Teacher M: "No, not yet, but that is what it is leading to."
Facilitator: "Then you should ask yourself: in this period have I …?"
Teacher M: "Yes, that's right…"
Facilitator: "… worked in a less traditional way and did that create a good working atmosphere? Try to convert all the aims for which you created the study scheme into a question, so that you can gradually see whether you have achieved what you wanted to achieve."

Teachers reported back that they found this method of facilitation helpful, especially as they attempted to realize *proportionate attention* to the domains of knowledge and making *links* between them. Facilitators confirmed that. Instructions and questions based on the four key assumptions for action research mentioned in the introduction, played an important role. For instance: "Have you also asked your students about that?, How do you know that your assumption is correct?" Facilitators reported that they started to ask questions like these after they had familiarized themselves with the key assumptions. The facilitator of network D adopted this approach to facilitation sooner and more often than facilitators A and B. Facilitator C did it in the first year more than in the second year. Indirect guidance, by encouraging teachers to question each other based on the four assumptions for action research, was only slowly adopted, mostly in network A. With regard to *freedom of choice,* facilitator D commented noticeably more often than the other facilitators on the relationship between the objectives of the school and the teachers' objectives. He regularly asked questions such as: "What are your

objectives?, How do they relate to the objectives of the school?" For example:

> Facilitator: "When I read your piece it makes me think: You write about the development of the school in general and the policy of the school management team. That's fine, but you don't write about what you want to do about that or what you can do from the position you are in."
>
> Teacher O: "Oh, I did not really understand it like that."
>
> Facilitator: "Yes, action research must serve the school but at the same time you need to take something that you think: that is not how I would like it to be, I question that, I could play a role in that or I would like to work on that."

The teachers in network A hardly linked the school's objectives with their own objectives if at all. They pushed the school's objectives to one side as being "too big". On the advice of the facilitator they chose "a new topic that affected them more directly", "something that frustrated them on a daily basis". For example: Teacher K wanted at first to work on introducing a student-monitoring system in the whole school. "After a difficult search for a way to work on this using action research", the facilitator reported, he suddenly spoke up in the network meeting:

> Teacher K: "I know. I know now what I want to work on. Something that I keep coming up against, monitoring of absences. Why are some students absent from school so often? That is something you deal with every day, something I deal with!"

Facilitator: "And you would like to improve that ...?"

Teacher K: "Yes, I would like to improve that, because it is a constant source of frustration!"

Later teacher K reported: "One of the points that the facilitator made to us was that it is a good idea to choose a topic from your day-to-day practice, something that is a source of frustration to you. Later he denied that he meant this, but it still helped me at the time."

Finally, regarding *dealing with knowledge,* it emerged that teachers made connections between their own insight and understanding and general knowledge when facilitators showed them or encouraged them to seek out literature in response to the concrete performance of their action research.

4.4. Teachers' data and facilitators' data compared for categories and domains

The data regularly show a parallel increase in teachers' focus on *proportionality* and *link*. The relationship between these two categories and *freedom of choice* and *dealing with knowledge* was less clear. In the proportionality category it was noticeable that the teachers' attention went through phases. Left to themselves teachers often focused first on desired manifestations in the technological domain of knowledge and then on actual manifestations in the empirical domain of knowledge. Only after that did they also pay attention to actual effects in the empirical domain of knowledge and desired effects in the ideological domain of knowledge. This phasing is represented visually in Fig. 3.
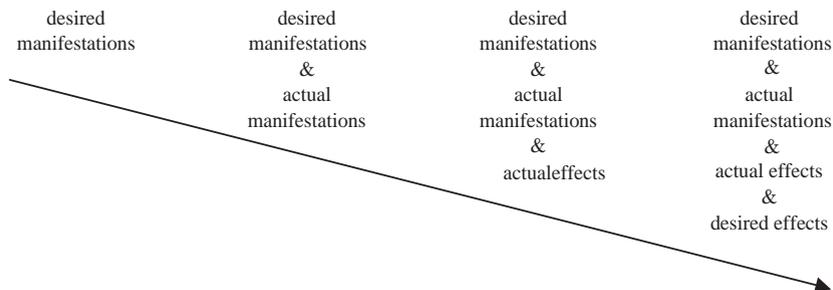

Fig. 3. Phases of attention paid to the domains of knowledge by teachers.

The phases the teachers went through in their focus on the domain of knowledge was paralleled by the attention devoted to the domains by the facilitators. It appears that by giving proportionate attention to the domains of knowledge themselves, the facilitators encouraged the teachers to do the same. For example:

The facilitator referred to desired effects (ideological domains of knowledge): "You wanted to encourage students to take more initiatives themselves and to ask questions. You used the term 'the inquisitive questioning' students." Then he asked about actual effects and actual manifestations: "You used a survey to get the students' views. Can you briefly say what this exploration produced?" A discussion developed about the interpretation of the data (empirical domain of knowledge) in relation to the teachers' objectives (ideological domain of knowledge):

Teacher B: "The students see independence as 'doing it on your own'. Only a few mention 'asking questions' as well. For most of them working independently means working individually. 'Asking questions' is not part of that and so neither is 'taking initiative'. Just 'pick up your book or your work'."
Facilitator: "So if you are working on your own that means you are working independently. And if you link this to your general idea about the problem? Is this the opposite to what you expected?"
Teacher B: "I did not expect this."
Teacher A: "One of the things you said was that students are often more independent than many teachers think. That was one of your assumptions."
Teacher B: "That may be true, but it is not what we mean by working independently, it is not what we want."
Teacher C: "They don't associate working in groups with working independently."
Facilitator: "How do you think they arrived at that view?"
Teacher B: "As I understand it, they learned it in the past. Keep your mouth shut and get on with your own work."

Finally, the facilitator asked about desired manifestations (technological domain of knowledge): "What could you do in response to what you have learned from this exploration?, What do you want to improve now in your approach?"

Teachers reported that they found discussions like these supportive and facilitators confirmed this.

4.5. Development as reported by the teachers themselves at the end of the program

Table 2 summarizes the development by category as reported by the teachers themselves at the end of the program (in the interviews and the documents). The table shows that these findings largely match the development deduced by the researchers from the other data sources. Dealing with knowledge is an exception to this. The researchers found that this category did occur in networks B and D (see Table 1), but it was not mentioned as a gain by the teachers. In general the teachers were rather more positive about their development than Table 1 indicates.

With regard to *proportionality* and *link* teachers implied that their reflections had been enriched by focusing not only on the technological domain of knowledge but also on the empirical and ideological domains of knowledge. Teachers learned as they said, "to view practice from more perspectives", they "think about what they are doing more" and they "have learned always to investigate what is really happening". Most teachers reported on their gains in the domain of *freedom of choice* in terms of "realizing that you can influence your own practice". The teachers in networks C and D also mentioned "realizing that you can influence the situation in which that practice takes place". Almost all the teachers mentioned choosing their own objectives as an important gain from taking part in the program.

5. Conclusions

In the introduction to this article we stated that the process of developing professional knowledge

Table 2
Development by categories as reported by the teachers themselves at the end of the project

	Network A $n = 5$	Network B $n = 4$	Network C $n = 3$	Network D $n = 5$
Proportionality	± Attention given to the empirical, technological and ideological domains of knowledge. Within the empirical domain of knowledge, focus on actual manifestations with occasional attention given to actual effects.	+ Attention given to the empirical, technological and ideological domains of knowledge. Within the empirical domain of knowledge, focus on actual manifestations with some attention given to actual effects.	+ Attention given to the empirical, technological and ideological domain of knowledge. Within the empirical domain of knowledge, focus on actual manifestations with some attention given to actual effects.	+ Attention given to the empirical, technological and ideological domains of knowledge. Within the empirical domain of knowledge, focus on actual manifestations and actual effects.
Link	± Linkage mainly between empirical and technological domains of knowledge, only occasional links made with the ideological domain of knowledge.	± Linkage mainly between empirical and technological domains of knowledge, links more or less made with the ideological domain of knowledge.	± Linkage mainly between empirical and technological domains of knowledge, links more or less made with the ideological domain of knowledge.	+ Linkage mainly between empirical and technological domain of knowledge, and regular links also made with the ideological domain of knowledge.
Freedom of choice	± Choosing your own objectives. Two teachers mention: realising that you can influence your own practice.	+ Choosing your own objectives. Three teachers mention especially: realising that you can influence your own practice.	+ Choosing your own objectives. All three teachers mention especially: realising that you can also influence the organisation by engaging in dialogue.	+ Choosing your own objectives. Daring to base your practice on what you think. All teachers mention especially: realising that you have an influence, not persisting with things in the organisation where you have no influence.
Dealing with knowledge	—	—	—	—

Meaning of the scores: + *Major* gains reported for the category, ± *Some* gains reported for the category, — *No gains or very minor gains* reported for the category.

through action research concerns insights and understanding that teachers develop themselves. These insights can be distinguished from the general knowledge developed by academics that teachers also use in practicing their profession. General knowledge concerns understanding certain aspects of reality, whereas the term professional knowledge as used in this article concerns knowledge about how to act in specific, complex and unpredictable situations. Following Riedel (1977), professional knowledge was broken down into three domains, the ideological, empirical and technological domains of knowledge. Within these domains we distinguished four actions and skills that teachers might have to master to develop knowledge, and consequently it would be the facilitators' role to help them to master those actions and skills. These are concerned with 'proportionality, 'link', 'freedom of choice' and 'dealing with knowledge'. Based on Riedel's theory, it was assumed that the domains of knowledge can be distinguished in a formal sense,

but that they are in reality integrated in purposeful and responsible practice (praxis).

This case study examined the performance and facilitation of action research in as natural a situation as possible. We think that the findings might also apply to similar situations in which teachers (individually or in groups) carry out action research using the method followed in the ARTE program, whilst being facilitated in small groups at schools by teachers from teacher education institutions. The expectation that the results would be valid in similar situations can be defended on the grounds that the action research in the study was carried out and facilitated under different circumstances (in several schools and in several networks with different compositions). A stable picture was found to emerge under these circumstances. We have reached the following conclusions based on this picture.

Empirical evidence could indeed be found for the domains of knowledge and the skills and actions distinguished, and they provided a good framework for analyzing and interpreting the research material. The assumed necessary integration of the domains of knowledge in praxis based on Riedel's theory, however, turned out not to be present in the teachers at the beginning but developed in phases. Teachers concentrated first of all on the technological domain of knowledge, followed by the empirical and ideological domain of knowledge in that order. These findings are corroborated by Handal and Lauvas (1987) among others, who studied reflection by teachers in Norwegian secondary schools. They distinguished three levels of reflection in their study: (1) reflection on action, (2) reflection on practical and theoretical considerations, and (3) reflection on moral-ethical judgments. Handal and Lauvas established that teachers do not achieve the two higher levels of reflection on their own. More recent research supports their findings (see Day, 1999, for an overview). Based on the findings of this study, we can add that left to themselves teachers focused on knowledge about what they wanted to do (manifestations) and rarely on what they wanted to achieve through that (effects). At first, therefore, they reflected mainly on desirable action and not on what they were actually doing.

This meant that left to themselves teachers developed knowledge mainly in the technological domain and did not develop much knowledge in the empirical and ideological domains. The findings show that teachers could be encouraged to broaden their reflection. It emerged that as the program progressed teachers more often (1) devoted proportionate attention to the different domains of knowledge, (2) made links between the domains of knowledge and (3) used their freedom of choice. Networks B and D used general knowledge (dealing with knowledge) to some extent and networks A and C did so only occasionally. Only occasionally did network members manage to take general knowledge and raise this for discussion. The integration of the domains of knowledge in praxis deemed to be necessary also did not happen on its own. Teachers came to devote proportionate attention to the domains of knowledge in parallel with the extent to which facilitators did the same. This means that the phased attention described above reflects the development the teachers went through and not a necessary or desired phasing of the facilitation. The teachers also learned to master the other actions and skills in the theoretical framework ('link', 'freedom of choice' and 'dealing with knowledge') probably due to the influence of the facilitators. Facilitators seemed to be most successful when their support was offered to teachers repeatedly on the job as they did their action research. These data seem to support a recommendation that those involved in facilitating teachers to do action research should pay explicit attention to the domains of knowledge and their associated actions and skills from the outset.

The teacher developing professional knowledge through action research was given an active role but this does not mean that the facilitator automatically had a monitoring or non-directive role. Our findings show that facilitators do need to direct. Direction per se did not appear to be the most important departure from traditional transfer models, in which the facilitator transfers theory via instruction and the teacher is then expected to apply the theory (see for instance Elliott, 1989). The difference might be better defined more by what is directed and how. First, in traditional

transfer models the facilitator mainly directs the development of knowledge at the first level (see Fig. 1). In a facilitation model in keeping with the development of professional knowledge through praxis the facilitator mainly directs the development of knowledge at the second level. In this article that means teachers' insight into how professional knowledge can be developed in the ideological, empirical and technological domains of knowledge through action research. Second, in traditional transfer models facilitators offer linear-sequential guidance, that is they break down the material to be learned into separate units which they then offer separately and sequentially through instruction in advance. In a facilitation model in keeping with the development of professional knowledge through praxis, the facilitators' guidance is cyclic and process-oriented, that is they focus repeatedly on different aspects of professional knowledge at the same time and on the job as the teachers carry out their action research.

Based on the findings the conclusion might be drawn that the majority of teachers who took part in the program did indeed develop knowledge at the second level. The question is to what extent did these developments persist in the complexity of their day-to-day practice after the program was finished. Our study is unable to answer this question. As stated, left to themselves teachers tended to concentrate on the technological domain of knowledge. On that basis we could assume that daily practice tempts teachers to seek immediate, technical solutions. Conceptual skills (in this study making the link between the three domains of knowledge) risks disappearing into the background. Further research could reveal how far teachers apply their second-level knowledge to their practice over a longer period.

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