Science and Public Policy, volume 14, number 6, December 1987, pages 310-316, Beech Tree Publishing, 10 Watford Close, Guildford, Surrey GU1 2EP, England.

Scientific mediation

Amsterdam Science Shop and its influence on university research: the effects of ten years of dealing with non-academic questions

Rolf Zaal and Loet Leydesdorff

Providing some form of mediation between academic scientists and social groups that cannot pay for research is not only a matter of social service; it can also be applied as a form of science policy. An evaluation of 162 cases at the University of Amsterdam shows that investigations undertaken on behalf of clients of the local science shop have given rise to follow-up research, publications, and many other enduring effects on academic practice. An analysis of the relevant circumstances of these investigations reveals an interaction among institutional, motivational, and cognitive parameters of the impacts of the social demands on scientific knowledge.

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IS THE ULTRA VIOLET light used for drying in offset printing harmful to workers? Will more startling information arouse stronger opposition to the torture of political prisoners? What are the environmental consequences of milk drainings due to strikes in the dairy industry? Do the police treat heroin junkies with unnecessary violence? Are the electromagnetic fields generated by power lines harmful? Can lesbian and gay couples be competent parents as well as heterosexual pairs? Is the cleaner 'Danclan' harmful to dentures?

These are only a few of the more than 2,000 questions asked by clients of the Amsterdam Science Shop. For more than ten years, Dutch science shops have tried to offer socially under-privileged groups an opportunity to benefit from the university's stock of knowledge and research potential.

Although this practice has undoubtedly been a success in terms of social service, its effects on science and research are rather less obvious. Have the Science Shops also been successful in changing the course of university research? If so, have these shifts resulted in any new knowledge?

This article describes a systematic evaluation based on a quantitative survey of the effects of the mediation efforts of the Amsterdam Science Shop in terms of:

- scientific publications,
- the institutionalisation of new research programmes, and
- the substance of educational materials.

Moreover, we will examine the extent to which these effects can be related to cognitive or social factors. Since the science shops, as if by definition, exclude economic means for stimulating research, studies of this kind may reveal non-economic mechanisms in the mediation of demands for university research.[1]

In our conclusions, based on the analysis of aggregate data about university research induced by the science shop, we specify some of the conditions that have enhanced or inhibited the ability of the science shops to influence the development of the sciences and institutional research programmes.

 0302-3427/87/060310-7 US$03.00

Mediating departments

Science shops are university departments that mediate between academic scientists and groups that cannot afford to fund their own research. This is done with a twofold objective: to offer to these groups an access to the potential of academic research, while at the same time drawing the attention of academic scientists to the needs of quite a different audience.

In the Netherlands, probably more than in other European countries, science shops have now become familiar offices in universities. The one at the University of Amsterdam is probably the largest and most firmly established. It was launched in 1977 when a group of students and scientists took the initiative to mediate between academic researchers and groups that would not otherwise have access to scientific research.

After a short period of experimental performance, a growing number of clients and a surge of enthusiasm among members of the scientific community provided a strong legitimation that pushed aside initial political resistance.[2]

As expected, the rapid increase in the number of questions could not be maintained over the years. After reaching a peak in 1980, the demand seems to have stabilized in the vicinity of about 250 questions a year.

By the end of 1984 a total of more than 2,000 questions had been asked, most of which reflected concern about the environment, public health and labour. As Figure 1 shows, other fields like education and child care, social assistance, public housing, law, and the third world also gave rise to a considerable number of questions.

Questions received by the Amsterdam Science Shop are first evaluated in terms of whether the client meets the following three criteria; the client must be

- unable to pay for the research;
- without commercial motives; and
- able to implement the results.

Once a client's question has been accepted under this scheme, it is published in the university weekly newspaper. Staff members and students sometimes react spontaneously, but in most cases a member of the science shop has to search for someone willing to investigate the question. The workers of the science shop never do the investigation themselves; their aim is to stimulate others to reorient their research.

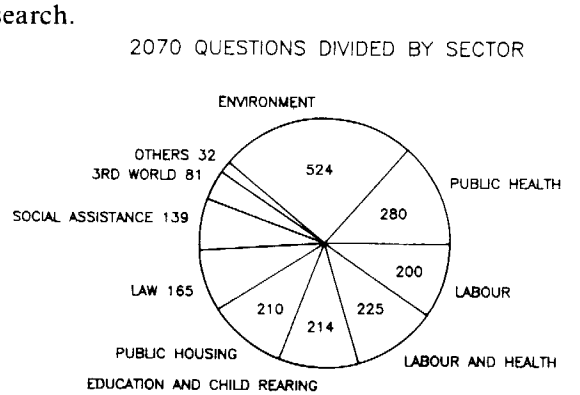

Figure 1. 2070 questions divided by sector

Almost any investigation undertaken on behalf of the clients of the science shop has some direct effect in terms of research and science policy

Once researchers are found, a meeting of the three parties is arranged. Appointments are then made, and the science shop drafts a formal confirmation. Although a lot of research may actually be done by students, the science shop accepts an agreement only when an institutional sanction for the co-operation is guaranteed by a formal commitment of regular staff members.[3]

Original questions

The questions asked over the counter of the science shop are obviously different from those which may arise in the minds of academic scientists or government science policy makers. Consequently, almost any investigation undertaken on behalf of the clients of the science shop has some direct effect in terms of research and science policy. Although this effect may seem considerable when measured in hours of scientific work, it is also trivial since it does not involve the cognitive dynamics of science: it is just a by-product of the service the academic community renders to the outside world.

Therefore, we looked for signs of a more enduring assimilation of the interests of the clients of the science shop. We chose to consider firstly a scientific publication[4] as a measure of influence on the contents of scientific knowledge; and secondly a follow-up investigation[5] as a form of institutionalization of a research line, and therefore an indicator of influence on an institutional research programme.

About 65% of the questions presented at the Amsterdam Science Shop can be answered simply by drawing on the scientific expertise that is already available from past research. Although answering these questions in many cases turns out to be intensive work for students, one would not normally expect these cases to contribute to the reorientation of academic research and science programmes. For that reason, the research reported here concentrates on the 395 cases that required some original research on the part of scientists. We found 162 of these cases accessible[6] to investigation.

Data about these cases was collected by means of structured interviews with 133 university employees who either carried out or supervised investigations on behalf of the science shop. Each of the respondents was interviewed for approximately 20 minutes about their motivation, their institutional position, the scientific impact of their work, the use of their findings, their relations with the clients of the science shop, and the circumstances that eventually stimulated or prevented them from developing follow-up investigations or scientific publications on the basis of their work on these questions.[7]

Since we chose to measure influence on the

institutional research programme and on the substance of science in terms of follow-up investigations and publications in professional journals, the number of cases with these effects could be established unambiguously. However, we were also curious to know something more about the way in which such effects take place.

To this end, all answers were reduced to scores on nominal scales, which were then processed in a two-step heuristic analysis. The first step consisted of a refined statistical survey to identify the factors influencing the chances of follow-up studies or publications. For this purpose, standard SPSS-routines were supplemented with an additional procedure that enabled us to look beyond the covariation between variables to the specific combinations of values that were causing (in the mathematical sense) the covariation.[8]

Since this first step showed us which factors had influenced the likelihood of publications or follow-up research, it was possible to identify the particular cases in which those factors were manifest. We then re-analyzed the interviews and made narrative reconstructions of these cases, which enabled us to gain a more detailed insight into the mechanisms of non-economic science and research policy.

Results

From the 162 cases under study here, which were selected because they led to a research report, 22 had led to 33 scientific publications or congress papers and 21 had resulted in follow-up investigations independent of the original question. In at least two instances, the follow-up investigations took the form of PhD projects.

In 53 cases, materials from the study were incorporated in educational material. In 5 cases, the interviewee explicitly reported a methodological development as an outcome of the study.

Figure 2 shows quantitatively how science shop research leads to resulting publications and follow up investigations and how other factors inhibit such results. Although there is a considerable overlap (8 cases) between the occurrence of cognitive and institutional effects these effects appear to be differently correlated[9] with circumstantial factors like the motives and the institutional position of the researcher.

Follow-up investigations for instance are facilitated by sympathy with the objectives of the client. This can

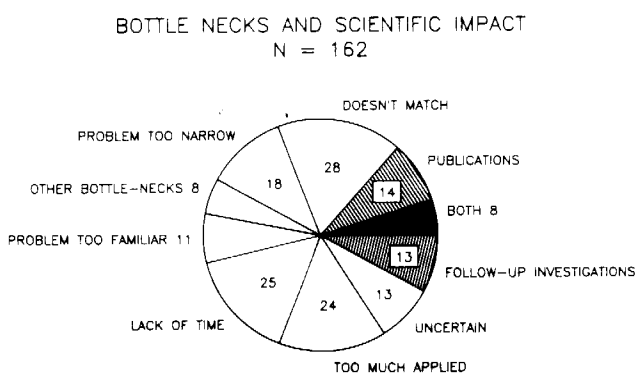

Figure 2. Bottle necks and scientific impact (N=162)

Of the 71 respondents who mentioned social motives for accepting the questions of the science shop 14 undertook follow-up studies - a significantly greater institutional impact than average

be illustrated with a series of studies in the sociology of public welfare, done by a strongly social motivated researcher.

Following a request by some disabled union members, an initial study of their social position gave rise to three follow-up studies. The first concerned the possibility of a correlation between the increasing appeal for funds for those deemed unfit for work and a more flexible use of the term 'sickness' among company physicians. No such correlation could be shown.

A second follow-up study, however, showed a correlation between the number of those found unfit and the economic state of trade in the respective branch of industry. A third study compared the chances of disability and recovery for men with those for women.

All these studies led also to the publication of articles in scientific journals.[10] Hence, we can really speak here of the establishment of a new institutional research programme.

This case is not unique: of the 71 respondents who mentioned social motives for accepting the questions of the science shop, 14 undertook follow-up studies. This represents a significantly greater institutional impact than the average, which finds its graphical expression in a growth of the follow-up sector in Figure 3 relative to Figure 2.

Follow-up investigations are not necessarily the result of a fruitful initial study: a number of parents who were disturbed about the high number of cerebral tumors among children in their small community presented their problem to the science shop. Chemical analysis failed to identify any suspect chemical component at the places where these children usually played.

This stalemate attracted the attention of an epidemiologist. His statistical analysis showed that there was no reason to assume a structural cause underlying the high number of cancer victims over

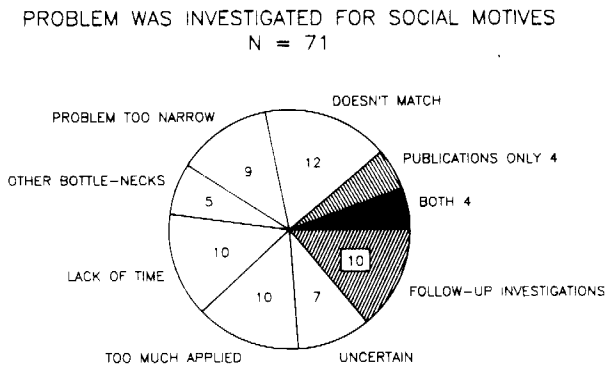

Figure 3. Problem was investigated for social motives (N=71)

the period under consideration; the parents' anxiety had apparently been aroused by nothing more than a morbid coincidence.

These results led to some theoretical reflections on the registration and identification of small epidemics in a journal for social medicine.[11]

Publications investigated

While social motives enhance the chance of follow-up studies, questions that were taken up primarily for scientific reasons appear to generate significantly more publications than others. This was, for instance, the case with a question about possible harm to moorlands caused by the increasing number of day trippers.

The science shop approached an ecologist who extended the scope of the original question into his more general scientific interest of moorland preservation. He found that a certain beetle named *Lochomaea Saturalis* caused much more damage to the moors than do recreation seekers. His study of the behaviour of the little creature that close-cropped considerable areas of moorland resulted in articles published in an international journal on ecology and in a semi-scientific monthly.[12]

Such scientifically motivated studies occurred 30 times in our sample. Eight of these cases led to one or more publications. This implies a significantly greater science policy effect than average, as shown in Figure 4.

Another factor that enhances publications and/or follow-up studies considerably is the access to data that would otherwise not have been accessible, through co-operation with clients of the science shop. There are several examples of such cases within our sample.

- Pressure from a panel of (former) psychiatric patients compelled the staff of a large psychiatric clinic to allow a university scientist to study their dossiers. The wealth of data on the psychiatric curricula of the patients inspired the researcher to undertake a follow-up study about the prevention of admission to psychiatric clinics for which he hopes to receive his doctor degree.
- An organization of (ex-)drug addicts made it possible for some students to engage in participant observation of the police handling heroin junkies. Their observations led to a publication in a sociological journal.[13]

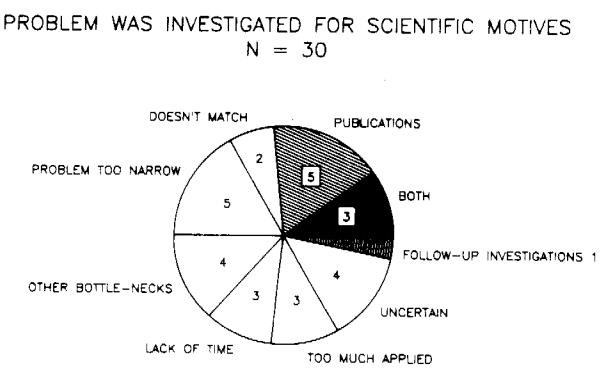

Figure 4. Problem was investigated for scientific motives (N=30)

Amnesty International wanted to know whether a more detailed presentation about torture of political prisoners would arouse opposition against violation of human rights or a more persistent disregard of the repugnant reality

- A request from a works council in a big publishing company made it possible for a group of students to study personnel dossiers for the purpose of comparing the career developments of men and women.

Along with the motivation of the researchers and the co-operation of the clients, it appears that institutional ties also play an important role in the reception of external problems. With regard to the institutional position of the researchers, for instance, it appears that the middle rank is (in terms of publications and follow-up studies) the most productive stratum of the scientific hierarchy.

This is mainly because of negative causation: students have no time to do follow-up research and usually no access to scientific journals. The first of these two factors also usually applies to professors.

Frustrating factors

In general, lack of time appears to be a significant factor preventing science shop investigations from having a greater effect on research or science policy. However, although mentioned explicity in 25 cases it is not the most important obstacle.

The most frustrating factors are "lack of connection with the current research programme" and "the too applied character of the question". These two factors account together for 52 cases without effect on research or science.

For instance, this was the problem with a question posed by Amnesty International, who wanted to know how the public reacts to information about the torture of political prisoners. Would a more detailed and shocking presentation of the facts help to arouse more opposition against violation of human rights, or would it, to the contrary, result in a more persistent disregard of this repugnant reality?

Although this study generated several ideas for follow-up investigations, none of these was realized because the programme of the psychology department placed a low priority on attitude and information research.

Of course, there are also questions which are really of no, or of very limited, scientific interest; 29 questions were said to be either too narrow or too well-known to warrant follow-up studies or publications.

Scientific relevance is, however, not always an imminent characteristic of research items. This is elegantly demonstrated by the questions that were reformulated by the researchers themselves. In these cases the numbers of follow-up studies and

publications are both dramatically higher than in others.

One such case was a request for an inquiry into truancy to support a union's opposition to government proposals for prolongation of compulsory education. The sociologist contacted by the science shop was not much interested in such an evaluation.

After some negotiation it was decided to extend the scope of the investigations into the social conditions underlying truancy. The originally requested data about the occurrence of truancy were of course included in the final report. The theoretical results of the study were presented at a congress and published in two different scientific journals.[14]

In our sample we found only 10 such reformulations, but this small group accounts for a surprisingly high score of 5 cases of publication (10 publications) and 4 follow-up studies. Reformulations of the original questions of clients typically involve the transformation of the problem from a descriptive articulation asking for an inventory and specific solution into something more interpretative, declarative, or generalisable.

The impact of reformulations by the researcher is impressive when we make a comparison between Figure 2 and Figure 5, which shows a considerable growth of both the publication and the follow-up fractions.

Five cases were said, in spite of their minimal cognitive interest, to have contributed to the development of methods of investigation. This happened for instance with the question of an SOS-telephone. Workers at this institution for handling crises wanted to know more about their accessibility, but rejected any method of investigation that would interfere with their practice. So a group of students, with the help of a professor in applied mathematics, designed a reliable method that enabled them to measure their accessibility without having to block the telephone numbers of the SOS-line.

Influence of receptivity

An intriguing question arises: are there any differences between branches of science with respect to their receptivity to influences of the science shop? The cases described above may give the impression that the influence of the science shop mainly pertains to the social sciences. However, this is not the result of any difference in receptivity to social influences, but rather of the composition of the sample.

If we divide the questions roughly into social sciences, natural sciences, and humanities, we find that 75.4% of our cases were social scientific, 20.1% in the natural sciences, and only 4.5% in the humanities.

However, there appears to be no significant difference in the relative frequencies of effects measured in terms of publication rates or follow-up studies. On average, 14% of the investigations in our sample concluded with a publication. In the social science cases this fraction is only 2% higher which is statistically insignificant. With regard to follow-up investigations, the corresponding percentages do not differ at all: both were 14%.

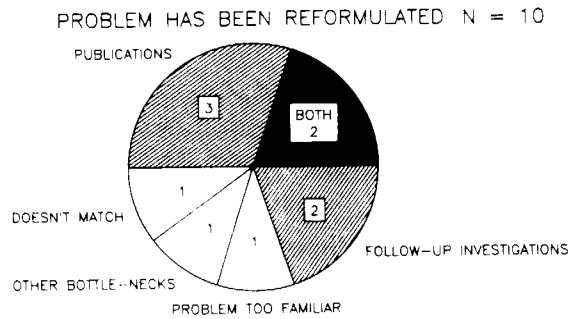

Figure 5. Problem has been reformulated (N=10)

There are two complementary answers to the question of why the social sciences should be predominant among the cases in absolute numbers. First, our sample is selective. Because of the exclusion of 45 cases at the chemistry branch office for methodological reasons, the natural sciences are under-represented.[15]

However, there still remains a considerable preponderance of the social sciences to be explained. Apparently most of the questions of the clientele of the Amsterdam Science Shop fit best within the scope of the social sciences. This does not necessarily mean that the natural sciences are less relevant for this group; it demonstrates only that these clients are likely to present their problems in concepts that are more accessible to investigation in the social sciences than in terms of the natural sciences.

The clients of the science shop seem to be better informed about the nature and possibilities of the social sciences.[16]

Conclusions

The science shop appears to have effects (beyond its function in the transfer of knowledge) as a marginal instrument for science and research policy. In addition to follow-up studies and publications induced by science shop questions, we found other cognitive effects such as improved access to highly relevant data, the improvement of research methods, the development of material for educational purposes, and reinforcement of lines of research that were not yet firmly established.

The scientific reception of non-academic problems does not depend solely on the intrinsic scientific relevance of the problem. There are institutional, economic, and psychological factors as well.

Nevertheless, cognitive factors play an important role in the scientific assimilation of social problems. Their position in the whole process calls to mind the image of a game of chess. Cognition plays the role of the king, whose interests are decisive, but whose moves can be strongly influenced by an interplay of other factors, such as the clever reformulation of a question of a personal interest in the matter under study.

To understand how different social factors like cognition, scarcity, personal feelings and institutional structures interact in the scientific reception of non-academic problems, one needs to abandon reductionist schemes like 'cognitive versus social' or 'internal versus external'. Such models obscure the fact that the relation between science and society is

Cognitive effects of the science shops include improved access to highly relevant data, improvement of research methods, development of educational material and reinforcement of lines of research

not one between two parties but rather similar to one between text and context.

This implies that the interests of scientists cannot be reoriented unless one considers their social position, their feelings with regard to the matter under study, their institutional position, and last but not least, the scientific career they plan to pursue. The fact that the Amsterdam Science Shop seeks to accommodate these circumstances may be the main factor explaining its relative success in influencing academic research.

Such non-economic strategies include appealing to feelings of social responsibility, providing opportunities to obtain rare forms of data, and looking for ways in which scientists can make a voluntary study productive for their future careers. These are the strategies of a science policy without the use of economic incentives.

This does not mean, however, that economics plays no part in the practice of science shop keeping. Although neither the shop nor the client has to pay for it, one should recognise that the work of academic researchers is not without costs. This fact is expressed by one of the most frequent obstacles to follow-up studies: the scarce time of university employees. Of course, 'no time' is a matter of priorities, but it is obvious that the impact of these priorities is economically determined.

There are opportunities in this domain for institutional management to improve the yield of the science shops as instruments for science policy. By enlarging the facilities for follow-up studies on behalf of science shop research it seems possible to broaden the scope of academic science and research through promoting the assimilation of non-academic problems that have already proven to be of some cognitive fertility. Such a policy may be feasible at relatively low cost when it is combined with the university's task to offer research opportunities to scholars who have just completed their university studies (PhD projects, for instance).

One should keep in mind that, historically, many lines of scientific research have originated from non-scientific problems. Of course, not every question can be a starting point for a flourishing scientific undertaking. Most of the questions posed at the science shop are instrumental, exploring ways to change circumstances without concern for the long-term effects or the broader issues which must be addressed by science and research policies.

Moreover, most clients are not seeking to reorient science. Therefore, scientists who intend to incorporate the needs and values of under-privileged groups in the course of their work need to reach beyond the *ad hoc* questions of science shop clients. The role of reformulations in our study demonstrates that practical problems are of a different kind from scientific questions. The science policy impact thus depends on the success of a translation or reinterpretation of the problem at issue.

Our results indicate that one can transform social problems into scientific problems through active reformulation of the questions of under-privileged groups. Such reformulation, with the help of some creativity and scientific skill, can be done without harm to the knowledge interests of the science shop clients.

Actually, since our definitions of cognitive effects have been rather strict, we expect more of those translation processes to have taken place implicitly than have been reported, and therefore, we believe that the mediation of questions for non-economic motives is more rewarding, in cognitive terms, than we expected when we started this study.[17]

Notes

1. It has proven extremely difficult to observe non-economic social influences in the study of large government-financed research projects. See for instance: W van den Daele, W Krohn, P Weingart, *Geplante Forschung*, (Frankfurt: Suhrkamp, 1979).
2. A change in the government's appreciation of the science shop movement can be located in 1979. In that year the Dutch government, in a memorandum about university research, declared itself in favour of granting free access for under-privileged groups to the university's research potential by means of science shops. (A memorandum on the function of university research in the Netherlands, *Second House of Parliament, session 1979-1980, 15 825,* nos. 1-2, page 42). Transfer points for commercial clients were institutionalised in Holland a few years later.
3. For more details about the Amsterdam Science Shop see also: T Ades, "Holland's Science Shops for 'made to measure' research", *Nature,* volume 281, 1979, pages 519-20.
4. Defined as a publication in a professional medium without direct links with the social relevance of the subject matter.
5. We distinguished betwen follow-up studies and parallel studies which, although they may concentrate on related subject matter, originate independently from the question of the science shop.
6. When we took our sample in November 1984, the Amsterdam Science Shop had just accepted its 2070th question. As of that date, 1842 questions had been passed through to academic scientists. Of the 1171 questions that had already been answered, 395 required some original research. In 158 cases, however, the science shop was unable to provide the name of the investigator (or the employee that supervised student researchers). Since the branch office for chemistry follows a somewhat variant model of mediation (they undertake research themselves), 45 of their cases were excluded as well. An additional 30 cases were excluded because the investigator could not be contacted. So the final sample includes 162 cases. Since sometimes more than one of these science shop questions had been answered by the same researcher, the total remaining number of respondents was 133.
7. The questionnaire for these interviews was compiled after pilot interviews with 27 researchers employed at institutes that did not belong to the University of Amsterdam. (The science shop turned to other institutions only when the required expertise was not available at the University of Amsterdam.)

8. After explorative testing of all the theoretically relevant variables at a significance level of 5%, all significant chi-squares were broken down into delta chi-squares for each occurring combination of nominal values. High value of delta chi-squares thus indicated combinations of values that required special attention. These important combinations of nominal values were treated as combinations of boolean variables, which were then tested on their covariation in 2x2cross-tabulation.
9. See note 8.
10. These studies were not included in the 22 studies that produced publications, since the three publications mentioned here resulted not from the original question but from its follow-up investigations.
11. M M Verberk, "Kleine epidemieen, grote problemen". *Tijdschrift voor Sociale Geneeskunde,* 1982, number 19, pages 544-8.
12. J T de Smidt, *et al.* "Hedendaags heidebeheer", *Natuur en techniek,* 1984, no 9 pages 691-709.
13. J Popken, "Handel en wandel op the Zeedijk", *Verzorging,* 1982, number 1, pages 47-53.
14. K M Bijlsma-Frankema, "Spijbelen; verzet tegen een etiket", contribution to the conference *"Onderwijs en Jeugdcultuur"* Nov 1981.
    K M Bijlsma-Frankema, *et al,* "The bevelende school", *Verzorging* 1983, number 1, pages 1-15. K M Bijlsma-Frankema, *et al,* "Structuur en interactie: twee blinde vlekken?", contribution at the conference *"Nederlands-Vlaamse sociologendagen",* April 1984.
    K M Bijlsma-Frankema, "Methodiek voor scholen om problematiek te benaderen", *CPS-blad,* 1985, number 4, pages 14-9.
15. See note 6.
16. L Leydesdorff, *et al,* "Trade union participation in university research policies", *International Journal for Institutional Management in Higher Education,* volume 8, 1984, pages 135-46.
17. L Leydesdorff, *et al,* "What we have learned from the Amsterdam Science Shop", in: S Blume, *et al* (editors), *The Social Direction of the Public Sciences. Sociology of the Sciences Yearbook, Volume 11,* 1987, pages 135-60.