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ABSTRACT

The effects of various megatrends in social and economic life on vocational education in Germany and other countries are discussed, and the evaluation of one approach to facing these megatrends is described. Trends include demographic changes and the conditions resulting from new technologies and environmental concerns. Such megatrends are changing the labor structure, with concurrent effects on vocational education. The demands on the vocational education system can be met only if research focuses on the process structure of education, emphasizing the processes of teaching and learning. Educational content must be related to usability in industry and administration, and teaching and learning must relate to real-world needs. The procedure used in a German program of vocational education is described. A systems approach to complex teaching and learning attempts to foster problem-solving behavior by teaching students how to handle factors derived from real-life situations. An evaluation of this approach in teaching business administration has indicated that commercial education can react to the challenges of the worksite and real life. Twenty-one figures illustrate the discussion. (Contains 75 references.) (SLD)

Multidimenional Evaluation of Longterm-Effects of Complex Teaching-Learning Arrangements - in the Context of Commercial Education[1]

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1. Defining the actual problem of vocational education: Challenges in life and in the worksite - interpreted as "megatrends"

The actual discussion of problems of the labor market - and consequently of vocational education and training as preparation for it - is stamped by the experience of different challenges. These challenges influence independently or in combination the shape of jobs and labor organization. The new dimension of this impact is given by the fact that nearly all industrialized countries are confronted by them in a comparable way and that consequences cannot be drawn easily by some slight modifications of given structures. For this reason, BUTTLER 1992 proposed the term "megatrends" to characterize these challenges.

The main research problem at the moment is that these "megatrends" on the whole are not described and explained in a theoretically sufficient way. Therefore, causes and consequences cannot be stringently related to each other. For that reason, these "megatrends" have to be discussed in a more fragmentary way even though a strong evidence is given that they influence the labor market in the same direction (cf. for Germany: DEUTSCHE FORSCHUNGSGEMEINSCHAFT 1990; for Austria: BEIRAT FÜR WIRTSCHAFTS- UND SOZIALFRAGEN 1989; for England: SENGE 1990; HARRISON 1992; for USA: COPA 1992). **Figure 1** gives an idealtypical overview on the trends and consequences found on the labor market. Trends and consequences can be shortly described as follows, whereby exogenous trends might strengthen the effects of the endogenous ones:

Demographic reasons

A shortage of workers and clerks can and will be observed in Germany, but also in other European countries: We have cuts in the pyramids of population (as results of the wars and of birth control techniques); the differentiation of the whole school system causes larger differences of grades and of age and by that - together with an increasing mix of nationalities - larger differences of prior knowledge when entering the vocational educational system. This leads to a decreasing demand for lower and middle labour positions which - in sum - forms a lack of skilled workers and clerks and causes a limitation of economic growth (cf. DEUTSCHE FORSCHUNGSGEMEINSCHAFT 1990).

Individualization of value patterns

Recent research has shown that we can observe a great change of values and attitudes. This coincides with a loss of belief in authority in private, economic, and political life. There are also processes of stimulation overflow or of fear of ecological disaster. Prosperity-influenced behavior on the side of the youth competes with attitudes of the older generation. The disposition of time gains a growing importance (ef. SEMBILL 1992; AUTORENGRUPPE SCHULVERSUCH ALLGEMEINBILDUNG ZÜRICH 1991).

Growing internationalization of economy

This phenomenon urges new efforts with respect to new dimensions of competition within Europe and worldwide.

Increasing number of research results and their transformation into technologies

The use of such results changes production and labor structures.

Increasing use of new information and communication technology

This causes changes in many workplaces and calls for intensive adaptation to the new conditions. Micro electronics lead to an automatization of routine work and also to new possibilities of a controlled decentralization of job structures (cf. BUTTLER 1992; STOOSS/TROLL 1988 treated this phenomenon by describing the media used at the individual workplaces). Vintage effects of knowledge infiltrate the working processes: Traditional school and apprenticeship do not adequately prepare for the handling of the new technologies.

Worldwide use of resources and of environmental conditions

The continuity of worldwide growth and internationalization of economy urges probably a reduction of the use of non-recycable resources on the one side and more consciousness with regard to the reduction of pollution on the other (ef. BUTTLER 1992; BUNDESINSTITUT FÜR BERUFSBILDUNG 1993; ALBACH 1993; GILGEN/BIERI/BISCHOFF/GRESCH/ZÜRCHER_1993).

These trends lead to consequences for the organization of labor:

Possibilities of a systemic rationalization

By this strategy new forms of organization are fostered which bring together isolated goals and tasks of different branches and divisions of large enterprises (BAETHGE/OBERBECK 1986). One example: Until now an insurance company had different branches: car insurance, life insurance, home insurance, and so on. And the clerks had mainly to control how the money rolls in; and in the case of car insurance they had to decide by fixed rules whether an accident should be treated in a "normal" way or not. But now the client is treated in a "holistic" sense: Is there a lack of insurance? Does the life insurance fit to the other branches of insurance? Does the client maybe need additional insurance? And so on. All this provokes an extension of the view on the client. And the training of that view urges continuing education and a change of the corresponding apprenticeship for the clerks.

Slimming down the hierarchical system

Together with processes of a systemic rationalization, actual management theory fosters a shrinking of the hierarchical system in enterprises; the slogan is "lean production" (cf. WOMACK/JONES/ROOS 1991; DAUM/PIEPEL 1992; as critique: WILLIAMS/ HASLAM 1992; BLOECH/BOGASCHEWSKI/GÖTZE/ROLAND 1993). This leads to enriched workplaces at which more decisions both independently and consciously must be made both in technical and in commercial divisions.

Increase of the "tertiary" domain

The "tertiary" domain is understood as the domain of services (in a general sense) and at the moment discussed unter three aspects (cf. BUTTLER 1992, p. 165 ff.; TESSARING 1993):

(a) We find a growth of the tertiary sector of the labor market at the cost of the agricultural and the production sectors.

(b) Within all sectors of the labor market, we find an increase of "tertiary" jobs, e.g. advising farmers with regard to commercial issues.

(c) Within a lot of jobs, there is an increasing part of "tertiary" activities, e.g. independent and responsible descisions on planning the next working steps etc.

Newer prognoses for Germany say that in the year 2010 about two thirds of all employees shall work in the tertiary sector. If one regards the whole "tertiary" domain as shown above, the estimation for 2010 grows up to 72%. These figures take into account the mutual dependency of the production and service sectors. The estimations also say that there will be a differentiated development of the different "tertiary" areas.

2. Possible consequences for the field of vocational and professional education and training

These "megatr nds" which changed and probably will continue changing the labor structure cause heavy influence in the field of vocational and professional education and training. As these trends are developing relatively independently, it is hard to bundle up the consequences in a stringent way. At the moment, we only have got the possibility to stress certain lines and points of the actual development found in enterprises and administration. As these consequences are discussed on different levels on argumentation and with regard to different areas of practice (cf. DEUTSCHE FORSCHUNGSGEMEINSCHAFT 1990), they only can be presented here as listing (see also all texts of the BIBB-2 Fachkongreß vom 9.-11.12.1993 in Berlin):

(a) The term "megatrends" suggests that the challenges in life and in the worksite change radically the conditions and prerequisites of vocational and professional education.

(b) These challenges are new in the sense that - caused by their structure and consequences - traditional procedures of organization, of teaching and learning do not work effectively in the intended direction. DÖRNER 1989 speaks of a "logic of failure". By this term is meant that our thinking and acting mainly follow linear structures and ignore that the "megatrends" provoke new goals and tasks which are more complex - compared to the traditional structures - in the following sense:

- They cover a richer content;
- a large number of variables with different degrees of transparency is embedded
- which form a network, and
- vary over the time (also non-linearly), and
- are polytelic (the problem of main- and side-effects of decisions which have to be made with regard to the tasks and problems).

(c) These facts lead most Western industrialized countries to considerations on how to foster, or to restructure or to renew the whole educational system. As the field of vocational and professional education on the one hand marks the bridge between the general educational system and the occupational system and coincides on the other hand with a critical age in the lives of young people, very much emphasis is given to the discussions of this field.

This enterprise-related and person-related increased complexity calls for new forms of treating employees - not only as adaptation, but also as accomodation: The development of personality has been becoming a major goal of leading enterprises. The German research report, therefore, stressed the maxim of the "coincidence of economic and pedagogical reason". Formulated in another way: Research on vocational and professional education has to react to these challenges: Young people must be prepared actively and consciously to fulfil the tasks at the worksite; but education must also develop and stabilize the personality. Research, therefore, has to describe and explain thoroughly the tasks and problems and to analyze and to construct teaching-learning processes within adequate environments in a new way.

(d) These new efforts are confronted with problems on the side of policy: With regard to the non-ignorable "megatrends", politicians in all countries and also in the centre of the European Community tend to solve these threatening problems with hasty decisions on the vocational educational system. Simple harmonizing strategies or the "European vocational passport" might here serve as examples. These trials of political decisions can be interpreted as processes of solving ill-structured problems by inadequate measures. The main problem is that politicians and bureaucrats ignore the quality of the new problems and, therefore, only consider main effects and do not sufficiently think of possible and probable side-effects which very often are counterproductive with regard to the intended main-effect. Such behavior illustrates DÖRNER'S thesis of the "logic of failure" (cf. also DÖRNER/KREUZIG/ REITHER/STÄUDEL 1983).

(e) One grave example of this behavior is the fact that with regard to the field of vocational and professional education, the politicians and bureaucrats of all countries mainly think in institutional and organizational categories. They try to gain their ends - which very often are inadequately defined - by changes of institutions and of tracks through the educational system. They are not used to thinking in person-related, content-related, goal-related and process-related categories or - globally - in pedagogical dimensions.

(f) I am convinced that it is necessary to foster a way of thinking which **starts** with pedagogical categories and **ends** with institutional consequences - or better: alternatives. We have to make politicians and bureaucrats aware of these patterns of argumentation. To do this effectively, we need extensive research.

Judging the body of research results in the field of vocational and professional education, one gets ambiguous impressions: On the one hand, there has been - especially in recent years - an increasing number of research projects. But the whole range of these projects, on the other hand, has many gaps; three of them, in particular, should be mentioned:

- The research has been run within different scientific disciplines, e.g. education, psychology, sociology, business administration, and within these disciplines by differentiated subdisciplines which do not communicate satisfactorily with each other.

- There is a lack of continuity in research.

- There is an overemphasis on institutional problems. So that, the political and bureaucratic bias is strengthened by research effort.

The disciplines involved in vocational and professional education, therefore, deliver at the moment mainly fragmentary and isolated results which cannot be easily combined or integrated in the form of broad and consistent theory.

In the following reflections I would like especially to discuss these problems with regard to research needs and to political decisions which are necessary. Although I try to formulate the problems in a general way, I will mainly use examples from the German system, and here especially from the commercial, administrative, and public services for two reasons: (1) About 62 % of all German employees work in this field (with an increasing tendency (s.a.)); (2) I specialize in this area of vocational education.

3. Process-orientation of research on vocational education

It is my conviction that the present and future problems of vocational and professional education which are caused by the "megatrends" ca only be solved rationally and effectively if the research focus is on the process structure.

This conviction is based upon the critique of traditional (German) didactic models and theories (cf. the overview in BLANKERTZ 1973) which focus on descriptive categories of 45-minutes lessons and neglect the midterm and longterm perspective (see ACHTENHAGEN

1984, p. 191-220). Didactic approaches which try to consider developments in the field of cognitive psychology also foster a static perspective (cf. AEBlI 1987). These problems correspond to the controversy on the product-process paradigm of research on teaching and learning. Although DUNKIN/BIDDLE 1974 stressed the process perspective, the mainstream of research followed product-oriented approaches (cf. SHULMAN 1986b; SHAVELSON/WEBB/BURSTEIN 1986; BROPHY/G00D 1986). By that, researchers mainly work with selected and limited time-points, and overlook the fact that most of the results of classroom teaching and learning are influenced by continuous and long-term processes (cf. ACHTENHAGEN 1990c, p. 647). BIDDLE/DUNKIN 1987, p. 123, write with regard to problems of longitudinal research: "Most research on the effects of teaching presumes a stable teaching environment and that effects will appear quickly. But the real world of teaching is far from stable, and teaching may have effects that cumulate or are delayed". A very wield formulation is that of BROPHY 1979, p. 743: "Thus a study involving 20 classrooms studied for 20 hours each is almost certainly going to be more valuable then a study of a single classroom for 400 hours or a study of 400 classrooms for one hour each, other things being equal".

These conclusions are also valid for research questions in the field of vocational education. But - emphasizing the processes of teaching and learning does not mean only keeping track of traditional teaching and learning procedures. It is necessary to develop new forms of multidimensional teaching-learning arrangements and environments by which vocational instruction can be run over longer time periods. But this is consistent with the international trend: as examples: PIETERS/ BREUER/SIMONS 1990; CROOKALL/KLABBERS/COOTE/ SAUNDERS/CECCHINI/ DELLE PIANE 1988; KLABBERS/SCHEPER/TAKKENBERG/ CROOKALL 1989.

There are different reasons for stressing the development, the implementation, and the dissemination of multidimensional teaching-learning arrangements and environments:

(a) A pragmatic reason: the complexity of such approaches (as computer-based simulation games, case studies, simulated offices, working-analogue learning tasks etc.) makes it possible to react to more than only one consequences caused by the "megatrends".

(b) Scientific reasons: it is possible to relate these multidimensional teaching-learning arrangements and environments by at least three different ways to scientific approaches:

- By these arrangements it is possible to model the instructional design with regard to the network structure which is run within the systems approach of business theory (cf. GOMEZ/PROBST 1987).
- It is also possible to consider research in the field of cognitive psychology which emphasizes networking with regard to theories of learning and retrieving information (as one example cf. NOVAK 1985).
- New didactic proposals can be considered to overcome the dualism of thinking and acting (cf. AEBLI 1980, 1981).

Summarizing, we can say that these arrangements offer an excellent way to leave the linear structure of traditional teaching and learning and fit vocational education to the complex

network-like structure of the new requirements at the workplaces. Different evaluative approaches show that adequately constructed and run arrangements do have positive effects (some examples will be shown later on in this text). This mixture of theoretical evidence and first substantial evaluation results should lead to promote this approach of complex, multidimendional teaching-learning arrangements and environments.

4. Some aspects of necessary research strategies

Discussing the development and the research on multidimensional teaching-learning arrangements, one has to be aware that at the moment neither vocational schools nor enterprises are prepared to adequately fit their procedures and arrangements to these new challenges in the worksite and in real life. Two reasons have to be mentioned: (a) the very traditional content structure, (b) the missing flexibility of teacher and trainer behavior.

ad (a): The very traditional content structure

Different aspects of the content problem are easily distinguishable (cf. ACHTENHAGEN, 1992a). There are several - in part overlapping - that are relevant to the discussion here:

(1) At a primary level, content is what defines the central relation between vocational education and work. Teaching-learning processes in schools and enterprises are mainly held for content purposes - a fact which is emphasized by curriculum theory but often underestimated by teaching-learning research. How this connection is defined for different professions depends usually, but not necessarily, upon the particular science and teacher education.

(2) Content appears at different stages and in different modes of representation. For example, it can appear as a natural setting, as a medium, as a book, or as an oral statement by teachers and trainers.

(3) There are different stages of transformation of content. SHULMAN 1986a, p. 9, defined three categories of content knowledge: (a) Subject matter content knowledge; (b) pedagogical content knowledge, and (c) curricular knowledge. This concept has been extended by other publications (SHULMAN, 1986b; WILSON/SHULMAN/RICHERT 1987, p. 113) - and also criticized (MCEWAN/BULL 1991). In any case the distinctions are useful: "Knowledge" is regarded as the "subjective" aspect of subject matter and "content" as the "objective." This allows us to make these categories more explicit. We have:

- content per se (represented by situations);
- content in its diverse disciplinary structures;
- content as represented by media (including the author's goal system);
- content as part of the knowledge of the individual teacher or trainer;
- content as part of the prior knowledge of the individual student or apprentice and as goal of the teaching-learning process;

- content as part of the examination system;
- content as part of the cognitive structure of examiners; and finally
- content as part of the cognitive structure of employers, agents of trade unions and the public.

There is no integrative structure for these points. They can be incompatible - a fact which depends upon the differing interpretation of content. We ran e.g. studies on the prior knowledge of students when entering commercial schools and its change by the formal instructional processes as part of vocational education. The results show that the differences between the students in understanding the underlying context concepts cause a lot of teaching and learning problems. WEBER 1993 and 1994 measured these effects by a networking method combined with a zooming-in technique where the students had to define central economic concepts. She could demonstrate that the understanding of context units varied not only on the intraclass level but also on the interclass level, especially when different teachers taught the classes.

These results can be related to research problems, especially the underestimation of content within teaching-learning research (as mentioned above): "It ist remarkable that, of all categories of analysis, the data for the substantive meanings covered in the classroom reveal the greatest variability among the teachers" (BELLACK/KLIEBARD/HYMAN/SMITH, Jr. 1966, p. 63,68). This phenomenon was also found in other contexts: DAHLLÖF 1972, p. 174, concludes with regard to Swedish studies that the validity in relation to the specific instructional content was of little value. SHAVELSON/WEBB/BURSTEIN 1986, p.53, emphasize (with respect to an unpublished paper of GOOD) that "broader issues of **what is taught** and **how appropriately** have been largely ignored". BROPHY/GOOD 1986, p. 369, say that "researchers need to pay more specific attention ... to the scope and sequence of the curriculum and to the specific subject matter goals and content taught in particular lessons". The most pregnant formulations are used by SHULMAN 1986a, p. 6: "Investigators ignored one central aspect of classroom life: the subject matter"; "the absence of focus on subject matter among the various research paradigms for the study of teaching" is characterized as "the 'missing paradigm' problem"; "the importance of content has been forgotten". The resurrection of interest in content (cf. BARR 1987) surely deals with the cognitive turning-point in psychology although newer approaches in the field of complex problem solving failed their tasks by the neglect of content. DÖRNER, for example, constructed a microworld LOHHAUSEN where a mayor had to run the affairs of an artificial town over a certain period (DÖRNER/KREUZIG/REITHER/STAEUDEL 1983). The research group investigated the behavior of the person who overtook the mayor's role and tried to identify good and bad problem solvers. There were many problems with the interpretation of results and their correlation with measures of intelligence and so on. This was caused by the fact that the researchers did not realize that three different types of content had been embedded into the project: the content modelled by the researchers; the content in the interpretation of the experimenters; and the content in the interpretation of the problem solvers. According to my judgment of that study - and others in the field of problem-solving -, these three different aspects of content - which were not controlled by the

researchers - caused the interpretation problems (ACHTENHAGEN, 1990b). To avoid such problems, psychologically-driven teaching-learning research has tended to choose physics and mathematics as the main content area. But research on the expert-novice paradigm shows that the "content" of physics also varies: Confronted with the same problems, experts observe, interpret, and handle content structures in other ways than novices do (cf. CHI/FELTOVICH/GLASER, 1981). Similar statements can be made in the field of mathematics.

These analytic views surely have influenced the fact that the content dimension gains increasing attention within classroom related research (cf. ACHTENHAGEN 1992a): STODOLSKY 1988 pointed out the importance of the variable content matter for instructional practice. SHULMAN has been leading a group "Knowledge Growth in a Profession" (cf. GUDMUNDSDOTTIR 1991). There are also several trials to describe content in a more general non-subjectspecific way (cf. KLAUER 1976; SCHOTT 1976) or more subject-related (cf. ACHTENHAGEN/WIENOLD 1975; ACHTENHAGEN 1990c). If we do not follow the way of thoroughly describing the content structure underlying the teaching-learning processes within vocational education we fail to become effective.

To summarize: What is understood as "content" correlates with the degree of expertise in the specific field. "Content" is not equal to "content"; it is defined by highly individualized and specified understanding of that specific content and its structure and, therefore, has to be defined with regard to specific situations with all their syntactic, semantic, and pragmatic components.

(4) A last dimension that I would like to mention here is related to the connection between educational goals and content (the main point of German didactic models). Is there a possibility of discussing content in a neutral way? Or does content change in relation to specific goals, questions, and perspectives? To give a small example: Does the same nuclear power plant (the content) stand for problems of generating electricity or for a certain risk to the neighbourhood? Here is where the interrelationship between pedagogical effectiveness and responsibility rules, and necessarily has to rule, the structure of didactic argumentation and action. It is also here that morality, ecology, ethics enter the didactic discourse for vocational education.

With regard to the actual needs of enterprises and real life - caused by the very new challenges - the actual content structure of vocational education should be discussed at least under the following aspects - where one remark is necessary: We collected the reported results from studies which were run within the last 20 years. All results show high stability. By the study of REBMANN 1993 we evaluated again learning material and found very similar structures.

(a) Content units (including the goals) are defined by situational aspects and thus should be operationalized on all possible levels. This requirement is currently not fulfilled. Different analyses show that according to BLOOM'S taxonomy of educational goals we have an overrepresentation of goals on the lowest cognitive level (KRUMM 1973, p.

85; ACHTENHAGEN 1984, p. 179): 97 % of items in classroom tests, 93 % of items in final examinations, and 85 % of items in textbooks fit in the category "knowledge". Only 11 % of the textbook items were related to the category "application".

(b) *Content units should be related to usability in industry and administration.* This requirement is also not currently fulfilled. Context analyses of curricula demonstrate that only 29 % of the curricular content for vocational full-time schools and only 45 % for vocational part-time schools are related to qualifications for vocational situations. The remainder is related to very general political and economic situations (KRUMM 1973, p. 43; ACHTENHAGEN 1984, p. 148). There is not one content unit dealing with students' situations as a seller-of-work. The practical needs of the worksite are neglected. It is also interesting to note that this analysis was done even before the impact of new technologies gained its present importance.

(c) *Content units are not concerned with the abilities of the students.* One of the main results of our analyses shows that the students and their needs and abilities do not really exist within the didactic literature. We analyzed teacher handbooks in the field of economic and commercial education and found that only 8 % of all sentences were related to the students, but without interrelationship to content and other instructional variables. About 44 % of these sentences were negatively formulated: the students and apprentices are described as relatively unintelligent, unmotivated, without discipline, and so on (ACHTENHAGEN 1984, pp. 25, 27). We found comparable results in the area of foreign language teaching (ACHTENHAGEN/WIENOLD 1975, Vol. 1, pp. 46, 51). Therefore, it seems to be very difficult to fit the new challenges to the teachers' and students' possibilities.

(d) *Content units should follow modern structures of life and not patterns of the "royal merchant" who stands on the barks and observes his entering fleet.* The structure of German textbooks for commercial schools has been laid in 1675 - according to SAVARY'S book "Le parfait négociant". The oldest textbook still in use in Göttingen has its origin in 1875 and is now in the 53rd edition. The mostly used textbock in Lower Saxony has its 187th edition.

(e) *Content units are linearized, chopped into pieces, distant from economic needs, distant from personal needs and abilities, and wrongly mixed (in other words there is an over-representation of traditional units such as law.)* The structure of curricula and the construction of textbooks corresponds to this fact (cf. REBMANN 1993). **Figure** 2 shows as example content and goals for the first 10 of 180 lessons of the curriculum for the school subject "Business Administration" in German Commercial Schools (NIEDERSÄCHSISCHER KULTUSMINISTER 1987).

The actual demand of enterprises (and also: of real life) cannot be satisfied by that content and curriculum structure. For management needs a personnel with explicitly given and trained abilities which are characterized as "key-qualifications" (cf. MERTENS 1974; REETZ/REITMANN 1990). Such qualifications are meant by the claims of network-oriented thinking, handling adequately complex problems, being able to work in teams and to cooperate, etc. (cf. BUTTLER 1992; TESSARING 1993; BAETHGE/OBERBECK

1986). Theoretically, these needs are stressed by the St. Gall systems approach of business theory (cf. ULRICH 1970; ULRICH/PROBST 1988).

But also the students and apprentices have problems with that linearized structure: The organization of the content units and the corresponding linear teaching procedures very often lead to patterns of rote learning; the mindfulness of the goals and content is kept hidden from the students.

ad (b): The missing flexibility of teacher and trainer behavior

Teachers, trainers and students are costumed to stay with these lists of goals and content units. Therefore, they are not able to effectively handle more complex teaching-learning problems which are proposed as alternatives. We find, consequently, a great gap between wonderful proposals of simulation games, case studies, simulated offices, projects, etc. and their actual use in the classroooms.

Another fact is that at a lot of faculties of economy simulation games and case studies are urged or run, but that these complex teaching-learning arrangements are not part of the compulsory lecture program. This is - for me - another strong argument for the thesis that teachers and students or apprentices do have problems with complex, multidimensional teaching-learning situations. We studied this phenomenon thoroughly over years (KAHLE/ACHTENHAGEN 1979; ACHTENHAGEN 1992b). Our starting point was that - when we ran the first time our simulation game and case study - we did not advise the teachers. We very soon had to notice that the test results of our experimental classes were not better than those of the control classes. By inspection of the videotapes of the discussion and decision finding processes of the simulation game groups we must registrate that the teachers did not foster, stimulate, summarize the group discussion processes, that there was a lack of critique and critical questions and remarks on the side of the teachers (cf. ACHTENHAGEN/TRAMM/PREISS/SEEMANN-WEYMAR/JOHN/SCHUNCK 1992; FÜRSTENAU 1994).

Another study showed that not only the cognitive domain but also the emotional and motivational were influenced by a non-expert teacher behavior. SCHUNCK 1993, p. 195, got the results that such a behavior does not have a positive influence on the learning processes, affects negatively the well-being and interest of the students, does not relate the questions of the students to the occupational reality, and provokes monotony.

The research-based development of new forms of effective teaching and learning has, therefore, to be especially aware of at least three crucial problems: (a) One has to think on a reform of teacher education and recurrent education with regard to the (necessary and adequate) use and handling of complex teaching-learning arrangements and environments (with regard to simulated offices cf. the recommendation in / TENHAGEN/SCHNEIDER 1993). This includes (b) that one has to think of the cont . dimensions of the whole curriculum and (c) that one has to think on the mid-term and long-term dimensions of the development of the students' personality and their higher order abilities (as problem-solving or "key-qualifications"). This point, especially, marks the bridge to a

consideration of learning with regard to the new challenges. The exploration of the time perspective within the years of vocational education may give decisive hints for an effective lifelong learning which is more than refreshing of a knowledge of facts.

The research should be organized as a combination of curriculum research and teaching-learning research; by that, it is focussed on perspectives of time and action. This research leads to new complex teaching-learning arrangements, e.g. computer-based simulation games, case studies, working analogue learning tasks, learning environments etc. The construction of these arrangements should satisfy at least five criteria: (a) The goals and the content of each arrangement should be of importance for the worksite. (b) The goals and the content should correspond to modern scientific research for the specific field of practice. (c) The students and the apprentices should judge the goals and the content as subjectively important and mindful. (d) The goals and the content must be conceivable and understandable. (e) The teachers and trainers must accept the arrangement and its background-theories and they must be thoroughly trained to effectively handle it.

The important point for the development of vocational education is whether these arrangements and environments also can be run within the Dual System. We developed our approach in commercial school systems where fulltime classes ("Berufsfachschule") and also parttime classes ("Berufsschule") were taught. We tested our proposals firstly in full-time classes and found that -as one partner of the Dual System - did not need more time for our complex teaching-learning arrangements in the experimental classes than in the control classes with "normal" instruction. The major reason was that we covered by our procedure more goals and content units - also of "later" parts of the curriculum. This experience led our teachers to tests of our arrangements also in parttime classes - with sufficiently positive results. This point was principly critical as - normally - the enterprises monitor the activities of the counterpart (here: the school) of the Dual System. We, therefore, are optimistic that we might change the whole 3-year curriculum of an apprentiship within the next years.

By the following paragraph I would like to demonstrate shortly our procedure.

5. Development of multidimensional teaching-learning arrangements - one example

Figure 2 serves as example for the long lists of goals and content in vocational education. As I said:

The actual demand of enterprises and administration cannot be satified by such linear content structure. A change is necessary. And this change offers a great intradisciplinary as well as interdisciplinary opportunity for didactics, educational psychology and the corresponding content-related sciences to develop new procedures of teaching and learning with regard to complex content and to higher learning and thinking processes. This does not mean that schools and universities should be forced to change their concept completely, but they must overcome the traditional linear series of goals and content (cf. ACHTENHAGEN/JOHN 1992; ACHTENHAGEN/TRAMM/PREISS/SEEMANN-WEYMAR/JOHN/SCHUNCK 1992; TRAMM 1992).

Figure 3 demonstrates very formally the whole context of our approach which is dominated by reflection on the content domain. We start with considering the qualification problems: academic disciplines (such as business theory) and practical needs on the worksite determine the goals of the teaching-learning processes. With regard to these aims we try to formulate an idealized thematic structure, or, in other words the goal and content structure best representing the practical and academic claims. **Figure 4** will show one example. We are confronted at this point with the problems of substantiation and legitimization. It is necessary to design constructions and to evaluate and revise them. The transposition into concrete content and teaching-learning procedures requires different steps: Thinking on students' needs, on their prior knowledge, their proficiency and motivation, relating the idealized thematic structure to single lessons and - more important - to sequences of lessons; pursuing the construction of meaningful subnetworks - by controlled procedures of content reduction; and thinking on a global evaluation concept that covers not only the cognitive, but also the emotional and motivational domain and proves whether the curricular content and goals lead to adequate actions. The most important, but until now not controlled domain can be described by the question, whether the teaching-learning processes in school stand the test in enterprises and administration.

This is possible if the didactic thinking in school and university switches over to network-like interpretations of the given curricula. **Figure 4** demonstrates the network structure behind the linearity of the list shown in **Figure 2**. The network is developed by using scientific statements on the one hand - above all from the field of business administration - and task structures found in larger enterprises on the other. This content structure, therefore, contains important and rich information on real life - and is of high relevance for learners.

Back to the attribute "multi-dimensional": This attribute gives a hint that the construction and evaluation processes of those arrangements must consider the importance and the interdependency of the following points:

- The network structure of goals and content units,
- sequences longer than one lesson of 45 minutes each,
- the use of computers and other technologies of information and communication,
- problems of teaching with the use of complex arrangements,
- problems of learning with the use of complex arrangements,
- levels of achievement and the development of personality.

With regard to these points, we are able to develop worksite- and life-related teaching-learning arrangements.

Connecting the teaching-learning processes to the prior knowledge of the students, we start the instruction of Business Administration for the first year in Commercial Schools by a movie of jeans production and certain paper sheets which use the information given by the movie. As our first complex teaching-learning arrangement is modeled by a computer-based simulation game, we start with an intricate information sheet for one of the different enterprises which have to be run by a group of students (**figure 5**). (This simulation game was developed by PREISS; cf. PREISS 1988, 1992). This sheet contains a lot of information

and also many expressions which are exactly defined by the theory of business administration. We introduce - together with this sheet - other sheets with pictures from the movie or bills or other commercial documents into the classroom (**figure 6**). The students have to handle these sheets, to identify the adequate information, to select the necessary information and so on. All these tasks are also carried out at the worksite. The students accept its importance (we measure the correspondend jugdments by interviews and questionnaires).

We prepare by these procedures the tasks which have to be run and solved during the following simulation game for about 20 lessons. According to a system-oriented approach of the theory of business administration, the enterprises which are modeled by the simulation game are organized as systems with subsystems and elements. The supersystem is given by the market and its relations. **Figure 7** demonstrates a first step to understand the supersystem-system relationship. The systems approach appears during the simulation game - that means: during the first steps into our curriculum - in a relatively general way: Primarily, we have got decisions on the number of goods to produce and on their prices. By that, the enterprises compete on an oligopolistic market.

To bridge the gap between complex and non-transparent information and teaching-learning procedures, we use didactic and psychological knowledge. We work with the complex network by moving within subnets (**figure 8**). Within these subnets, the student learns to economicly argue: The higher the production figure, the higher the total cost of production (**figure 9**). The higher the production figure, the lower the production costs per piece. The lower the costs per piece, the lower the price. The lower the price, the higher - ceteris paribus - the sales. The uncertainty of the market processes enter. And so on. All these steps are tutored by computer programs: The students can use the computer for calculation but also for visualization. **Figure 10** shows the decrease of costs per piece if the production figure rises.

Aim of this procedure is to develop the economic thinking and reasoning which uses fact knowledge within a complex argumentation context. Uno actu - this argumentation has to lead to decisions which are controlled by the system. The students, therefore, get a reinforcement; they are forced by the arrangement to prove success and failure of their decisions and actions and they have to formulate reasons as well as necessary and possible consequences for the following decision processes.

We differentiate the systems approach during the next sequence of the curriculum: The simulation game is followed by another complex teaching-learning arrangement in the form of a case study which is run over about 15 lessons. One example: Within the simulation game, all production material is set as completely available during all decision periods of the simulation game. By the following case study with the title "Selection of suppliers", the students have to ask for offers, to prove and to compare the conditions of these offers, to decide which supplier should be chosen, to justify this decision, and to act, that means to write the corresponding letters which contain the relevant information according to the decisions made (cf. JOHN 1992). The subject matter units of both complex arrangements are sequenced and specified with regard to the aims of the whole curriculum. We also try to bring together goals and units of different subjects: the balance sheet which is printed at the

end of each period of the simulation game has the same pattern as the balance sheet which is introduced at the same time within Accountancy, etc. (cf. PREISS/TRAMM 1990). By that procedure we try to overcome the cutting-into-pieces-strategy of the official curricula.

The other crucial point, besides the sequencing problem, is the mid-term and long-term development of problem-solving skills - and even more important: of the students' personality.

Within our project we try to foster problem-solving behavior which is combined - according to my understanding of learning for real life situations - with the handling of facts. We, therefore, observe the development of cognitive skills on five levels:

(a) We control whether the students learn facts which are proved by an external examination system. In the German commercial education system, the students have to undertake examinations which are run by the Chambers of Commerce, and not by the schools, in the form of multiple-choice tests. We, therefore, have to qualify the students by our complex teaching-learning arrangements for these external examinations, what means that we have to introduce a lot of facts which are evaluated on the level of multiple-choice items.

(b) According to the new tasks in enterprises but also according to our educational goals we try to develop content-related problem-solving skills. The decision procedures which are provoked by the simulation games, the judgment of alternatives, the discussion of main- and side-effects, the solution of complex algorithms - all these points can be interpreted as processes of complex problem-solving. These processes correspond to tasks in enterprises on one side and to tasks in the field of business administration on the other. We developed special questions to test these attitudes. A main specificum is that we construct these items in a very non-transparent way - comparable to tasks at the worksite. There is a lot of relevant, but also irrelevant information. The students have to decide which information is needed and they have to combine the given information for the solution of the item. For that, a lot of exact fact knowledge is necessary.

(c) The third dimension of evaluation is the proof by scientific criteria: We are able to control the effects of the students' decisions within their different enterprises by comparing figures of productivity, profitability, liquidity and so on, figures which were developed within the theory of business administration and used by all enterprises.

(d) The fourth dimension is to control the development of "key-qualifications": Are the students able to learn an effective argumentation behavior? Do they learn to handle problems weighing main-effects and side-effects, the pros and the cons of a problem. We did so by using an interpretation schema which was introduced by VOSS to describe the solution of ill-structured problems.

(e) The fifth point is the control of the motivational and emotional attitudes of the students. As cognition, motivation and emotion must be seen as unity, learning, especially in the long run, functions better with positive motivational and emotional conditions.

My impression is that this mixture (which has to be seen as integrated) of

- rote learning
- complex problem-solving in content-specific domain,
- control of decisions by scientificly developed standards,
- development of an adequate argumentation style, and
- of positive motivational and emotional attitudes might be a decisive prerequisite for an effective vocational learning. We evaluate this impression also by field studies which we run in departments of continuing education of large enterprises.

6. Evaluation of a complex teaching-learning arrangement

Our program was developed over several years (1985-1992). In this work, we were confronted with a severe problem: We saw on the one hand that we succeeded developing complex teaching-learning environments and arrangements, but that, on the other hand, the teachers - as said above - were not always able to handle them adequately.

We controlled the effects of our teaching-learning arrangements
- by videotaping the group and classroom processes, over months,
- by questionnaires and interviews, and
- by tests.

To control time-effects, we asked the students twice, in August (the beginning of the school year) and in the following March. I would like to report on data which show that it is not enough
- only to develop complex teaching-learning arrangements and environments.
- The decisive point is to qualify teachers as didactic experts. Teachers have to learn to handle these complex arrangements effectively. Students also must learn to use these methods. Vocational learning, therefore, must be seen in the context of teaching and helping for self-directed learning.

With regard to fact learning and to the solution of complex problem tests we succeeded (**figure 11**): The students of our experimental classes did significantly better than those of the control classes with regard to pure fact knowledge (n: = normal tasks) as well as with regard to subject-matter related problem-solving tests (ho: = higher order tasks). **Figure 11** shows overall posttest-pretest differences for different levels of significance. On the left side of the figure it is seen that the experimental classes had less losses of test item differences.

These clear results are won at the last evaluation period. During the former years we had to identify lacks with regard to the construction procedure of complex arrangements and to the teacher behavior. **Figure 12 and 13** demonstrate the development of profitability within two groups of one (poor) experimental class. The profitability went down dramatically; only group b marks a better result for the last period. We controlled these effects by an

inspection of the videotapes of problem-related group discussion. At that point, the teacher overlooked his task to monitor the group activities. **Figures 14 and 15** demonstrate the decrease of problem solving related utterances in group discussions over time. The students did not sufficiently debate the pros and cons of their decisions - with probable consequences for their success. **Figure 16 and 17** show another important effect influencing the learning processes: Success within the simulation game, concentration on problems and emotion and motivation are very close and can be seen as an unity (cf. ACHTENHAGEN, 1991; BECKER/PIEHL/OLDENBÜRGER, 1987).

By interviews and so-called "flash-lights" - very short questionnaires before and after the decision periods - we observed systematically motivation and emotion (cf. SCHUNCK, 1992, 1993). The whole content of the interview of all students of one classroom is represented in the form of a tree (**figure 18**). One can observe a differentiated structure, also in the field of teacher-student interaction. If we analyze the interview structure with regard to emotional problems, we can see that the branch of teacher-student interaction disappears (**figure 19**). The lack of teachers' knowledge to handle effectively the complex arrangements tackles not only the cognitive, but also the motivational and the emotional behavior of the students.

In a fifth dimension we investigated the midterm- and longterm development of problem-solving skills and of patterns of argumentation. In Germany, this problem is discussed under the heading "key-qualifikations" for the worksite. We used a procedure which was developed by VOSS and coworkers (cf. VOSS/TYLER/YENGO, 1983). We transcribed group discussions and analyzed them. VOSS - roughly spoken - was interested in detecting differences within the argumentation structure of persons with different economic background. He idealtypically separated novices and experts. **Figure 20** shows the argumentation structure of a novice, e.g. of a person with some basic economic knowledge (p. 217). The vertical lines symbolize a series of relatively isolated statements which are not well elaborated with regard to constraints etc. **Figure 21** demonstrates a typical finding out of our protocols (cf. JOHN, 1992). The difference to the novice structure is clear: fewer statements, but a better elaboration of the arguments. This result can be interpreted as some progress of handling subject-matter related argumentation structures. That means that complex teaching-learning arrangements and environments can foster a behavior which is needed in the worksite and in political and social life.

The sixth dimension of evaluation was the description of the structures of students' prior knowledge and its change as a result of the instructional process (cf. WEBER, 1993, 1994). The corresponding results will be discussed by the author within this symposium.

7. Some conclusions

In short, we would like to summarize:

(a) Complex, technology-rich teaching-learning arrangements are needed.

(b) Commercial education is able by these methods to react to challenges of the worksite and real life.

(c) Simulation methods are powerful tools; it is possible to foster uno actu knowledge of facts and knowledge of problem-solving with relation to specific subject matter. This might be a basis for general problem-solving techniques - and the opportunity for effective commercial learning might lie here.

(d) Complex teaching-learning arrangements can help developing affective skills and key-qualifications.

(e) Research on curriculum and teaching-learning problems can change the quality of goal and content structures.

(f) Three main problems can be specified at the moment:

(aa) The sequencing problem, that means the embedding of complex arrangements into a curriculum;
(bb) the optimal handling of the complex methods by the teachers and by the students;
(cc) the measurement of changes of knowledge over time.

All these questions lead to new and very complex research designs. But as we identify a lot of well developed complex environments and arrangements in different countries, we got the material to run our research effectively. By using these arrangements, we get a basis for developing, fostering, and evaluating teaching-learning processes in schools and enterprises by which we can prepare young people with regard to the new "megatrends" at the worksite and in life.

Figure 1: "Megatrends" in life and in the worksite

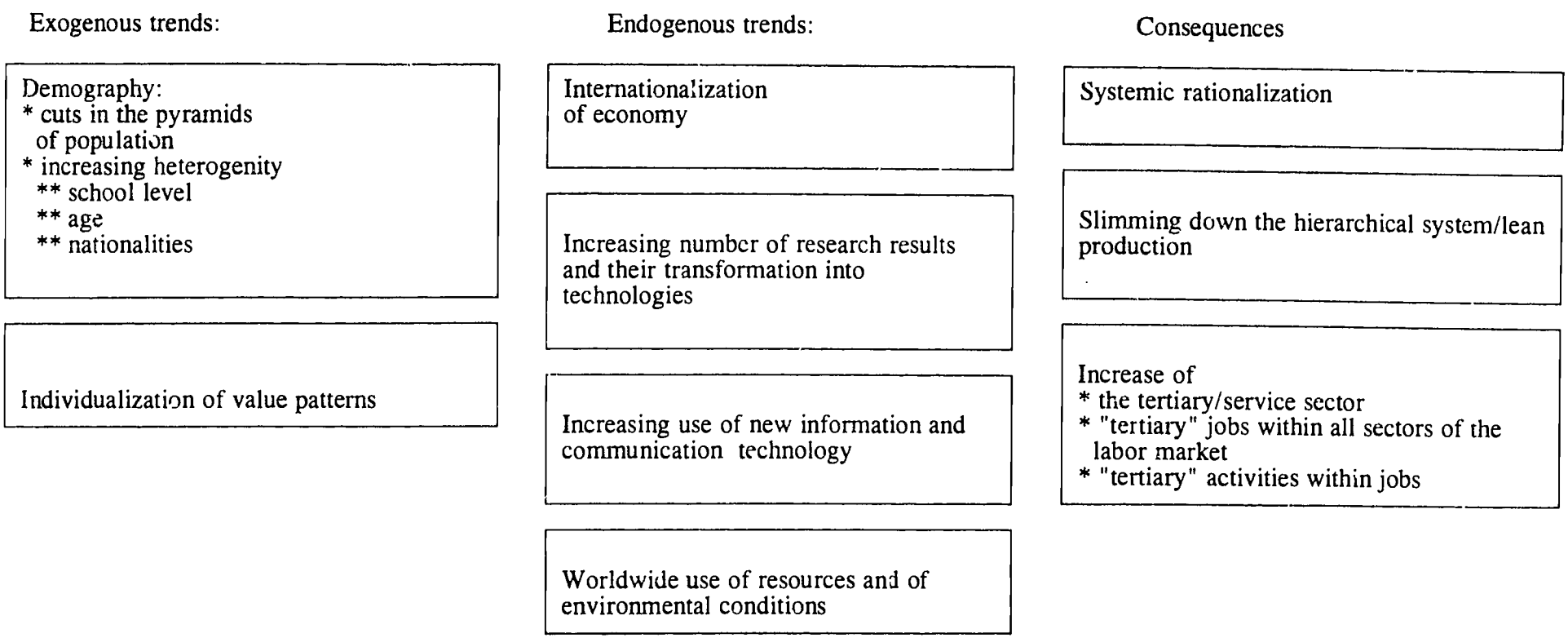
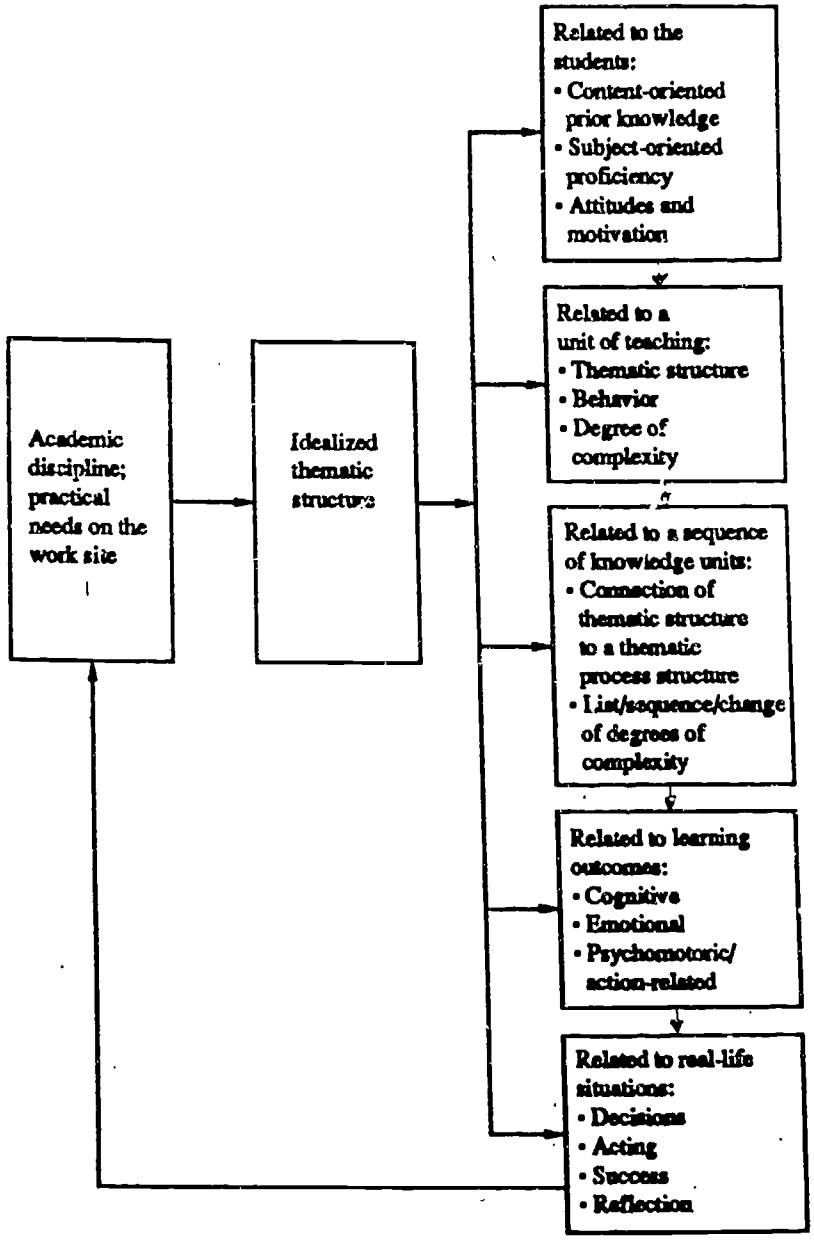


Figure 2: Content and goals for the first lessons in Business Administration

standard-time in lessons	content units	learning aims
10	1. <u>Performance Processes in Business and Administration</u>	The student should
	1.1 Private economic goals	- know the private economic goals
	1.2 Ratios for evaluation of the profit-making goal	- know and distinguish economic ratios for evaluation of the profit-making goal
	Productivity	- measure the quantitative yield of the use of goods and services
	Economic efficiency	- understand the necessity of acting according to the economic principle
	Profitability	- calculate the profitability as relation between deployed capital and profit
	Liquidity	- evaluate the solvency using the ratios of liquidity
	1.3 Public economic goals	- term serving the public welfare as purpose of non profit-making enterprises
	1.4 Goals of the public administration and judicature	- be acquainted with the social responsibility in administration and judicature by means of the state welfare assistance * -know life providence, security, order, stability of the law and justice as further goals * -understand the validity of economic principles to the public administration * -realize that for the public administration the ratio profitability is limited.
80	2. <u>Basics in law</u> ...	The student should ...

* = aims only for high achivers

Figure 3: Content in teaching-learning processes



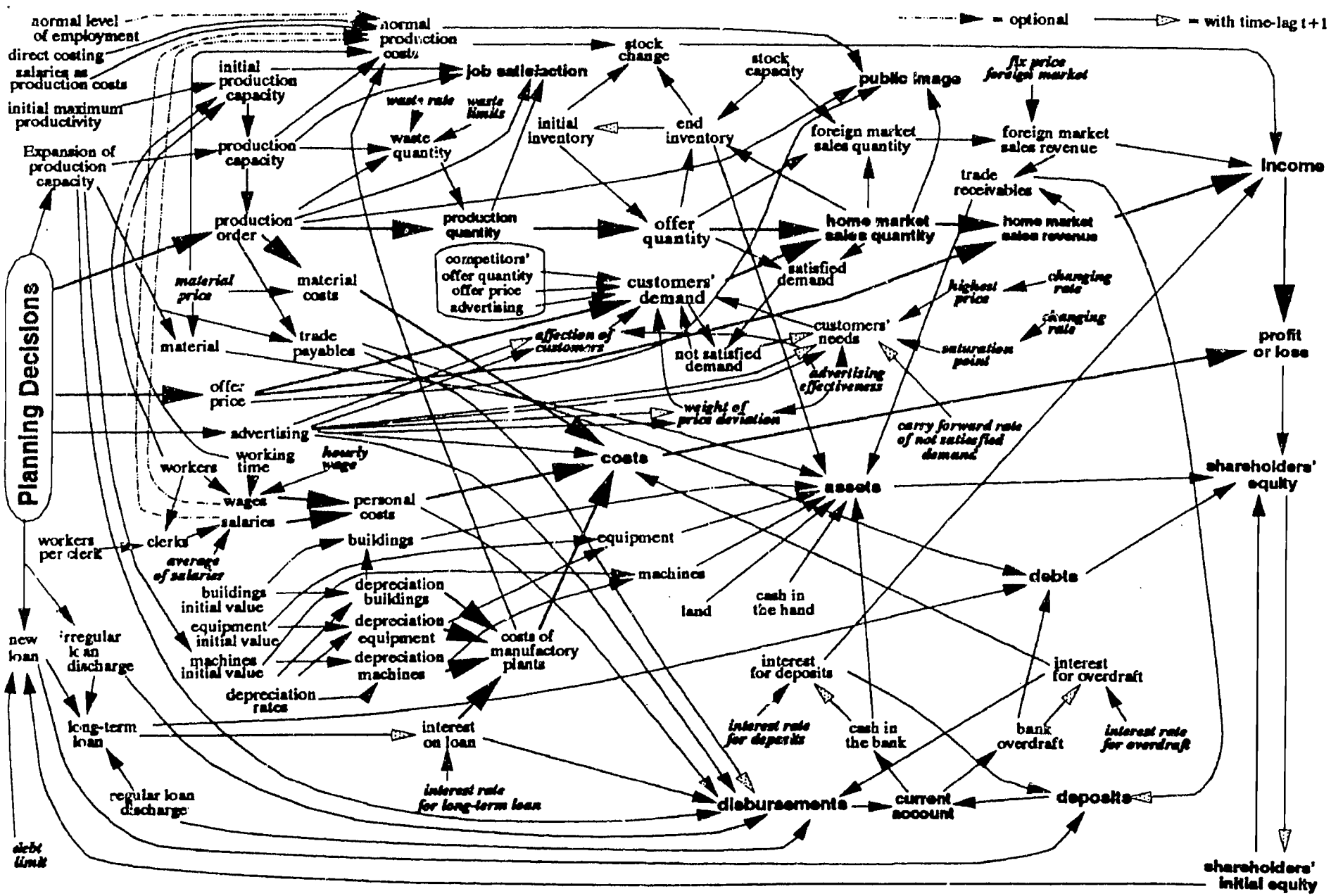


Figure 4: Reconstruction of the content and the goals for the first lessons in Business Administration - by means of a network approach

Figure 5: Part of an information sheet for one of the enterprises within a computer-based simulation game

General Business Information

Firm 1: Georgia Garments — Introduction 0/

The most relevant data of your business firm:

employees: workers: 305 persons
clerks: 61 persons

capacities: production quantity: 97,600 units at most per month
store for products: 97,600 units at most per month

inventory: material for production of: 24,400 units
value: 439,200.00 DM

products at sales store: 0 units
value: 0.00 DM

production plants	actual value	decrease in value by using and obsolence
land	2,635,200.00 DM	-
buildings	4,392,000.00 DM	14,640.00 DM per month
machines	3,513,600.00 DM	146,400.00 DM per month
equipment	2,342,400.00 DM	97,600.00 DM per month

Obligations by the loan contract:

- interest on loan: 28,284.48 DM per month

cash and trade receivables		debts	
cash in bank	233,866.72 DM		
cash in hand	7,565.00 DM	long-term loan	3,771,264.00 DM
receivables	3,782,976.00 DM	trade payables	1,493,280.00 DM

net worth (shareholders' equity): 12,082,263.72 DM

Working time and current prices for all firms:

daily working time: 8.0 hours
working days per month: 20 days

average of the hourly wages: 34.00 DM
average of the monthly saleries: 5,600.00 DM

material costs for production of 1 unit: 18.00 DM

interest rate on loan: 9.000 % per year = 0.750 % per month
interest rate for overdraft: 12.000 % per year = 1.000 % per month
interest rate for deposits: 1.200 % per year = 0.100 % per month

credit of our suppliers: 30 days without reduction
credit to our customers: 30 days without reduction

Figure 6: Example of additional information on the individual enterprise - run by the students

Land and Buildings

These are our manufacturing plants and our administration building.

When we established our firm we bought the area where we constructed the buildings. The bills of the building contractors were paid completely.

The land has an actual value of _____ DM.

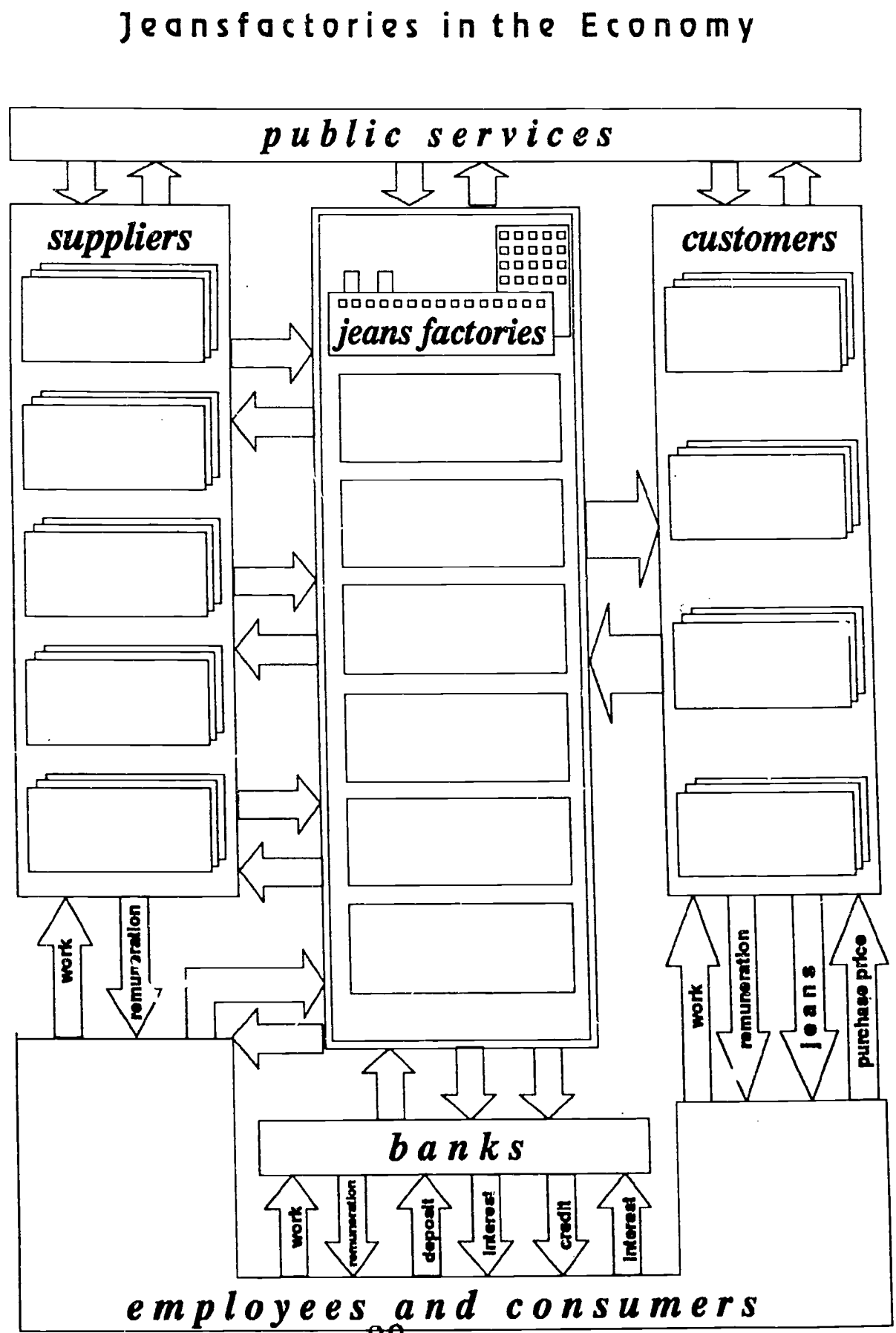
Because it doesn't wear-out, the value is unchanged.

The buildings have gone down in value constantly because of utilization and obsolence.

The buildings have an actual value of _____ DM

and their wear and tear is _____ DM every month.

Figure 7: Demonstration of the system approach of the simulation game



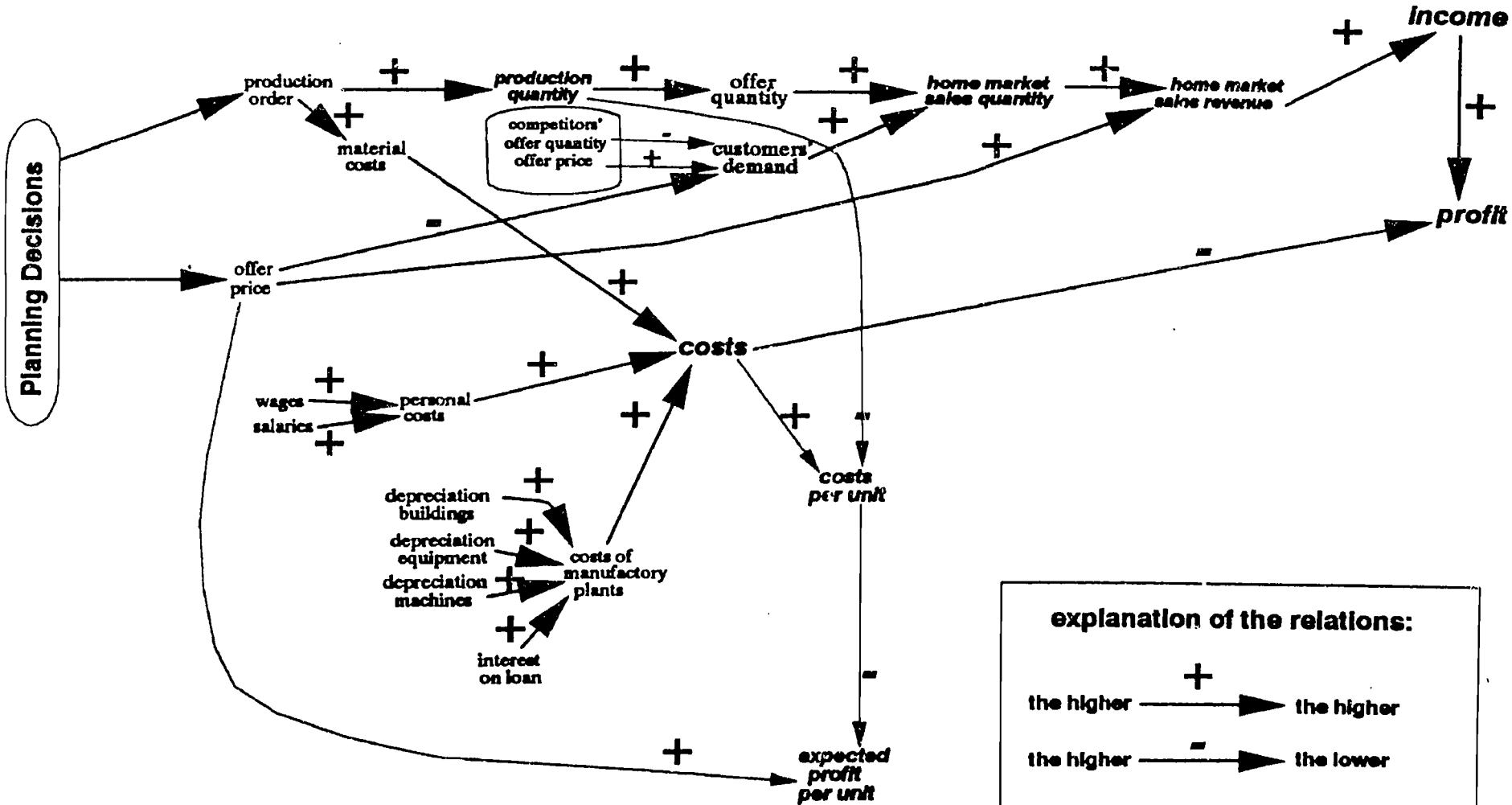


Figure 8: Subnet of the total content and goal structure of the official curriculum and the simulation game

Figure 9: Comparison of total production costs - a basis for economic reasoning

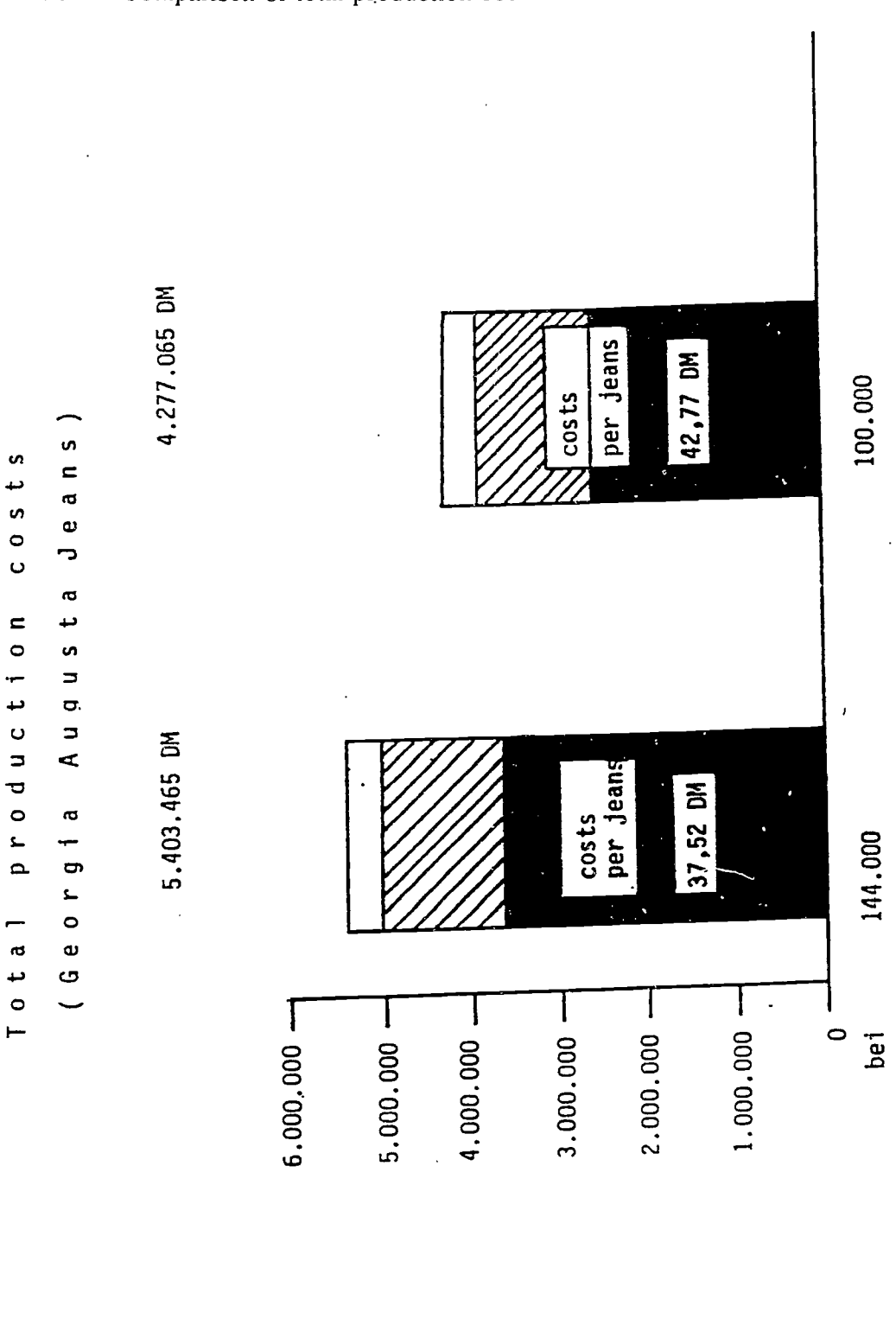
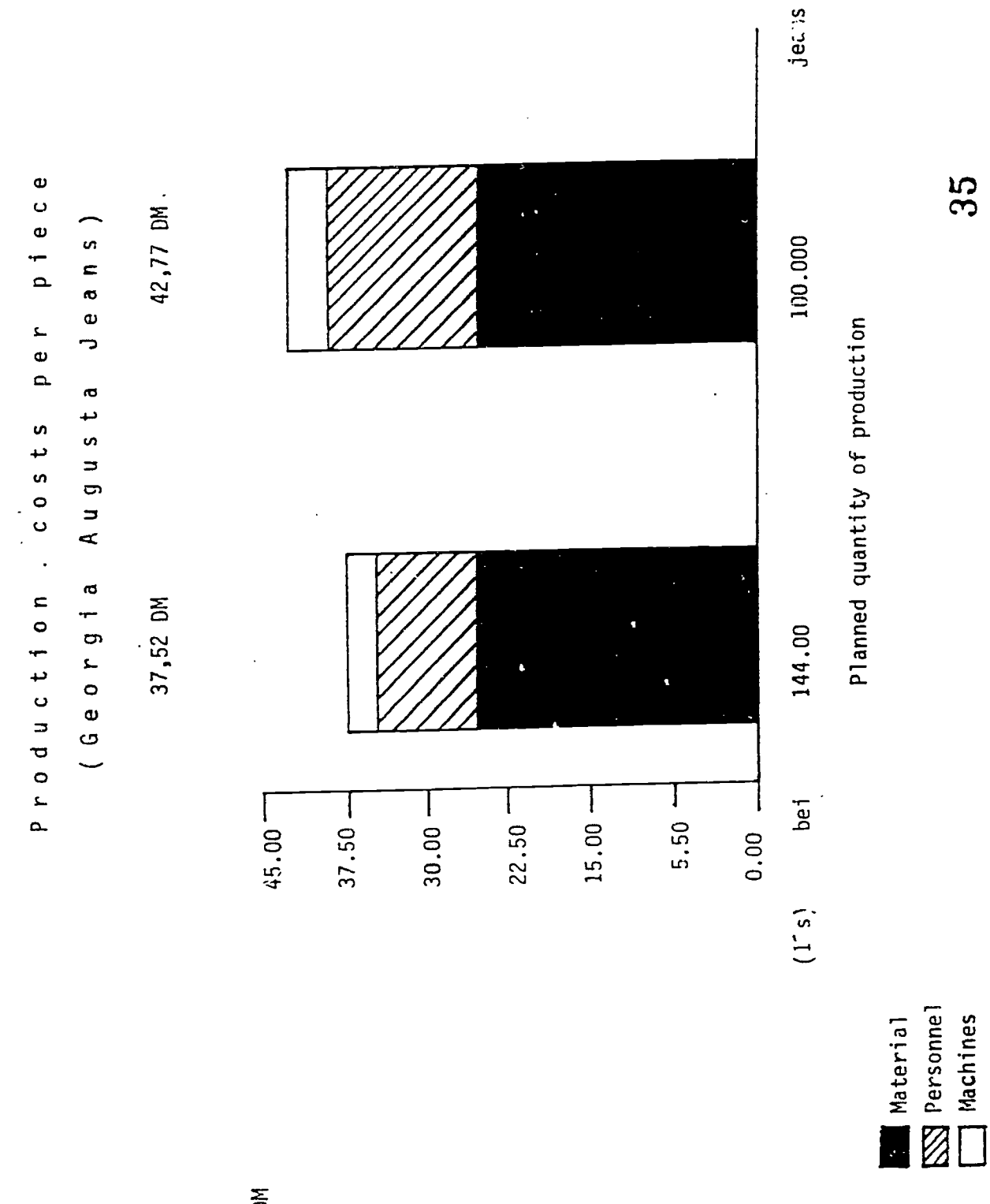


Figure 10: Comparison of production costs per piece - a basis for economic reasoning



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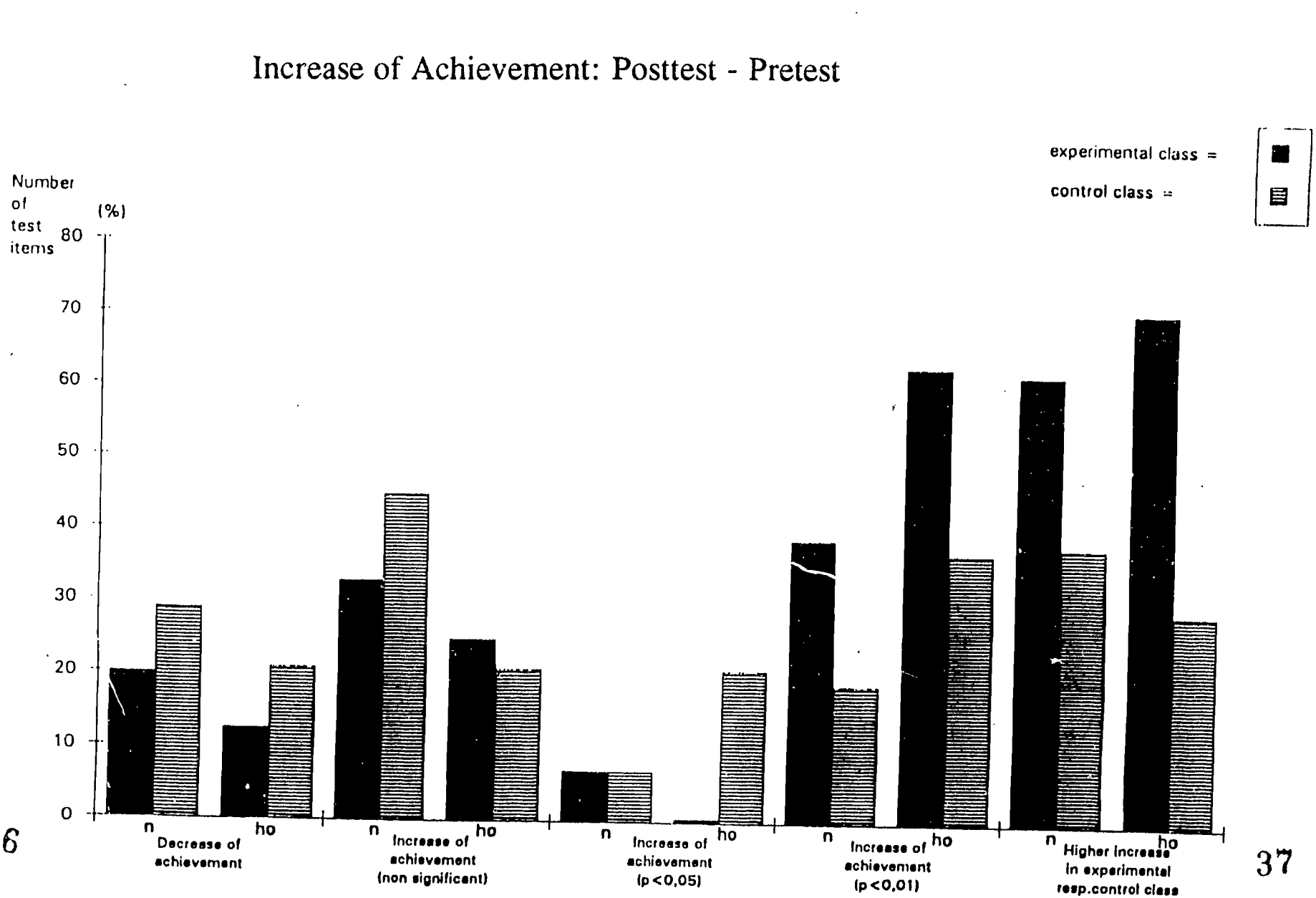


Figure 11: Increase of Achievement: Posttest - Pretest

Figure 12: Group 1a: Profitability

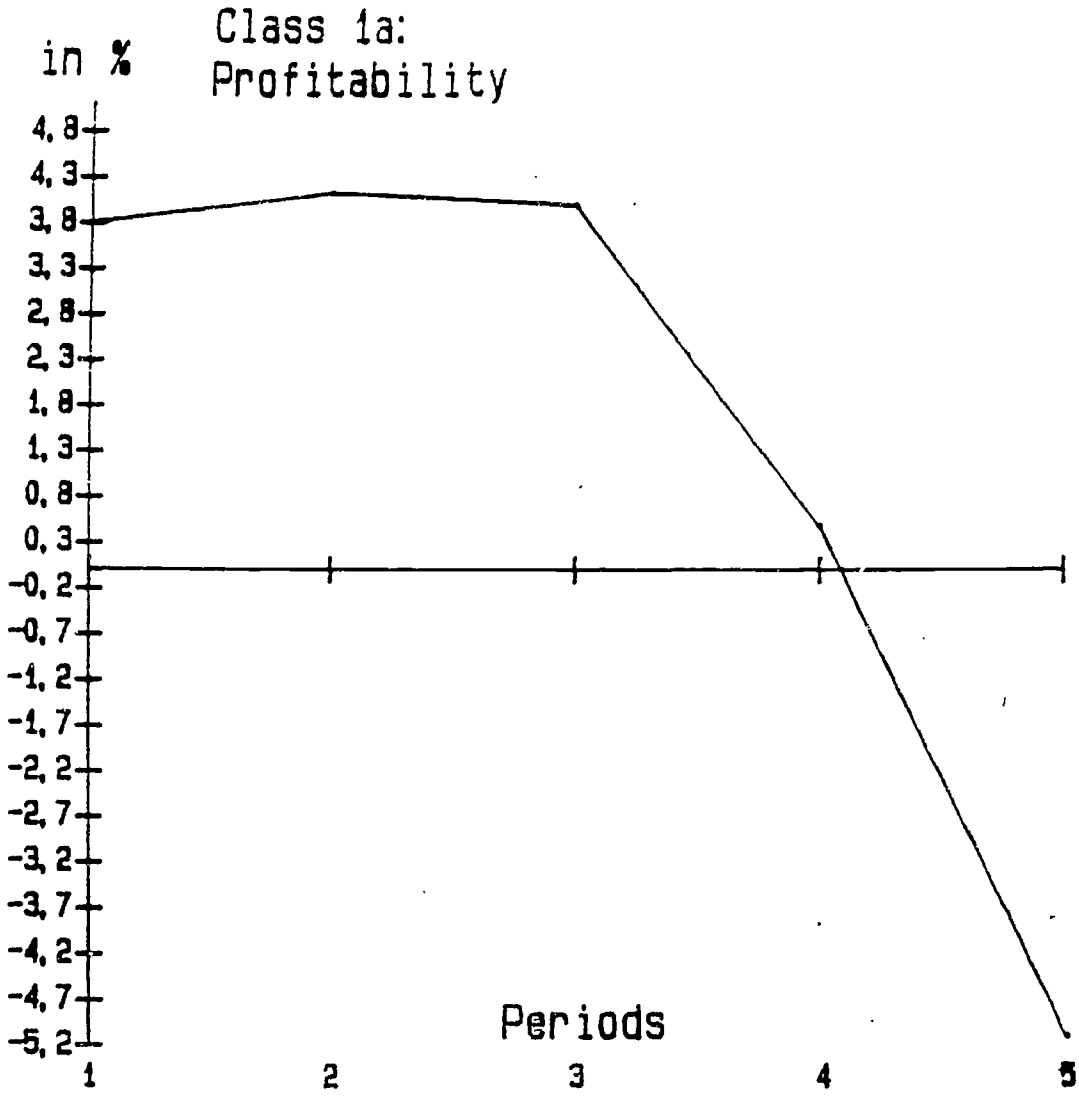


Figure 13: Group 1b: Profitability

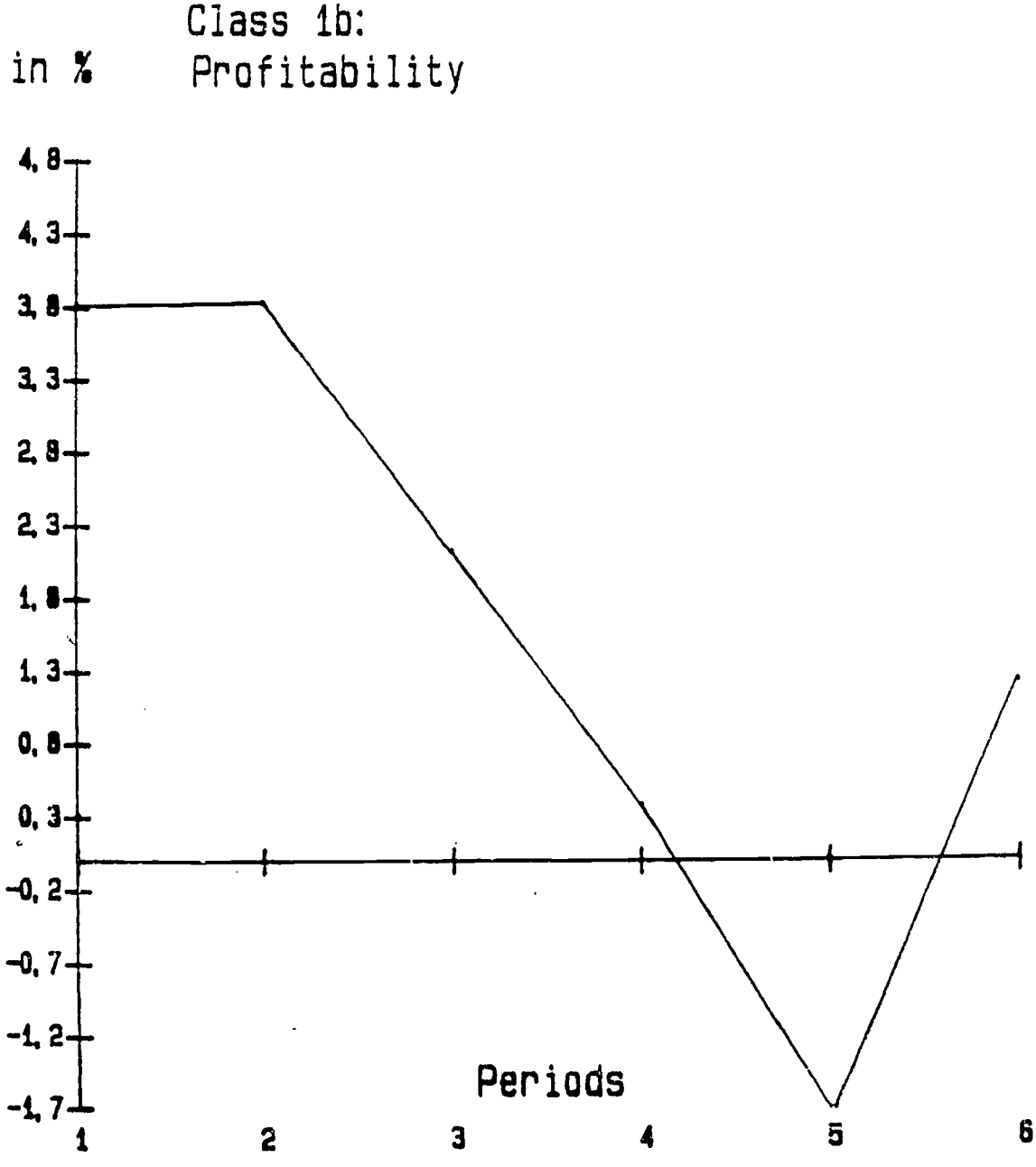


Figure 14: Group 1a: Frequencies of problem solving-related utterances in group discussion

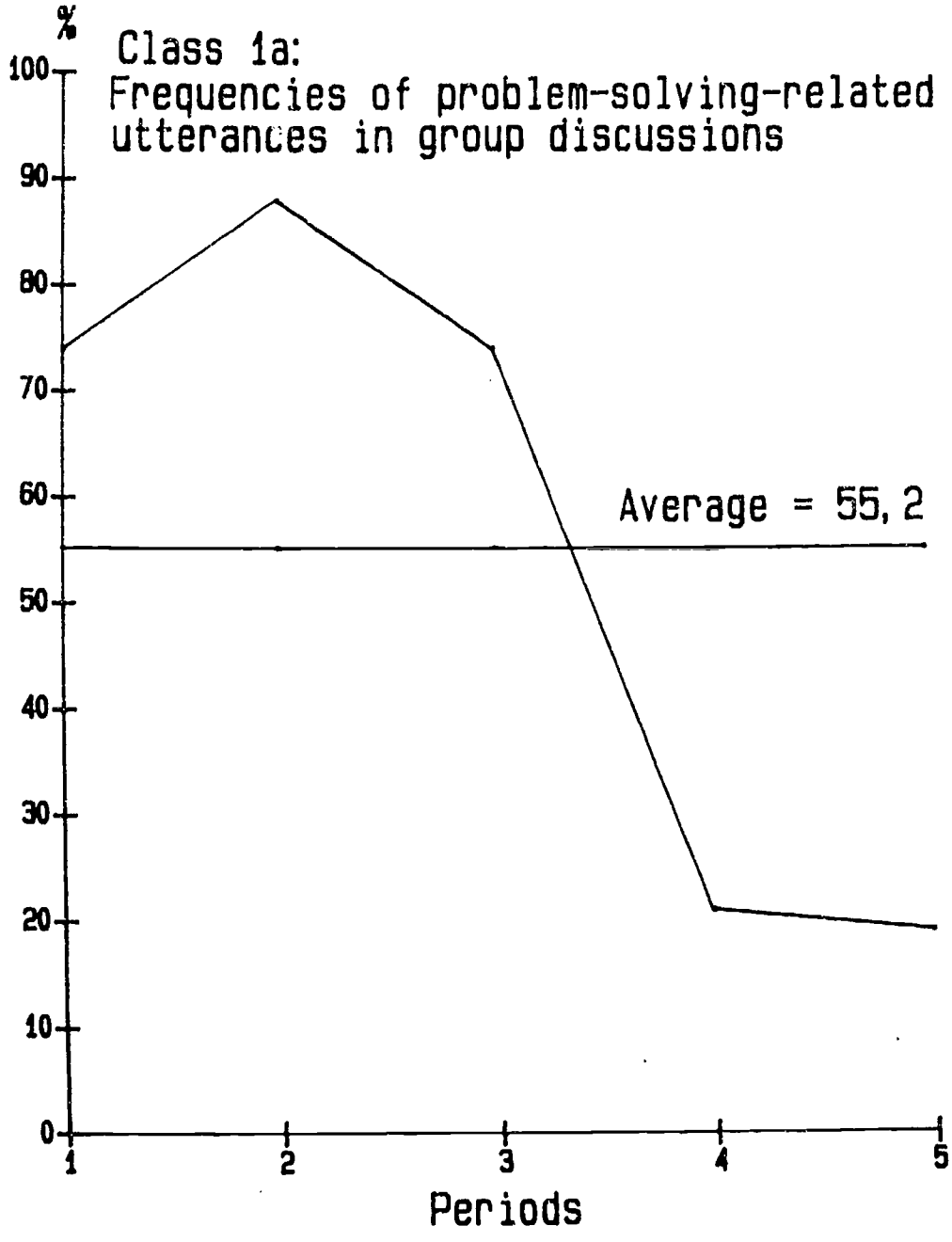


Figure 15: Group 1b: Frequencies of problem solving-related utterances in group discussion

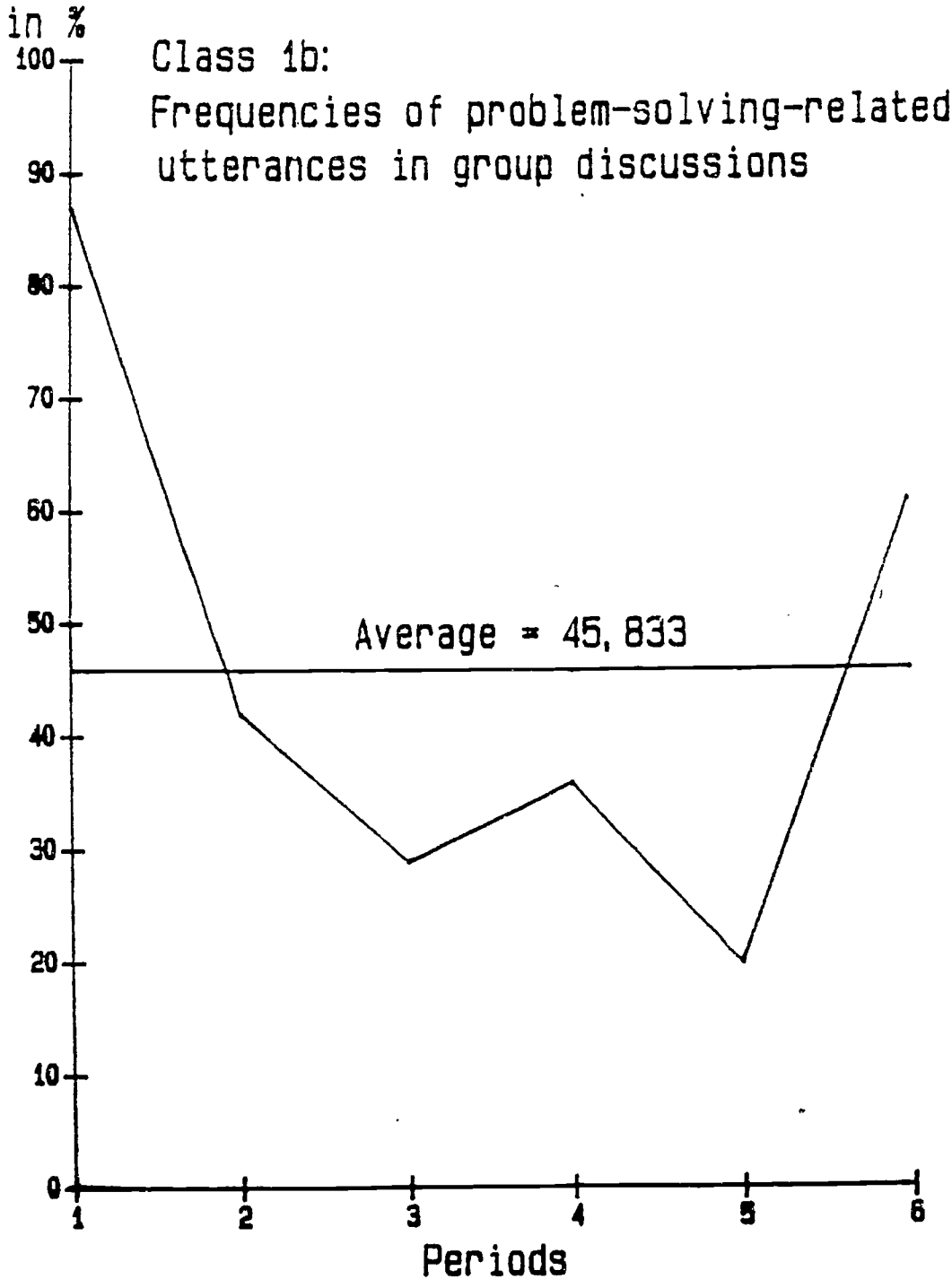


Figure 16: Group 1a: Positively toned emotional utterances in relation to the total emotional utterances

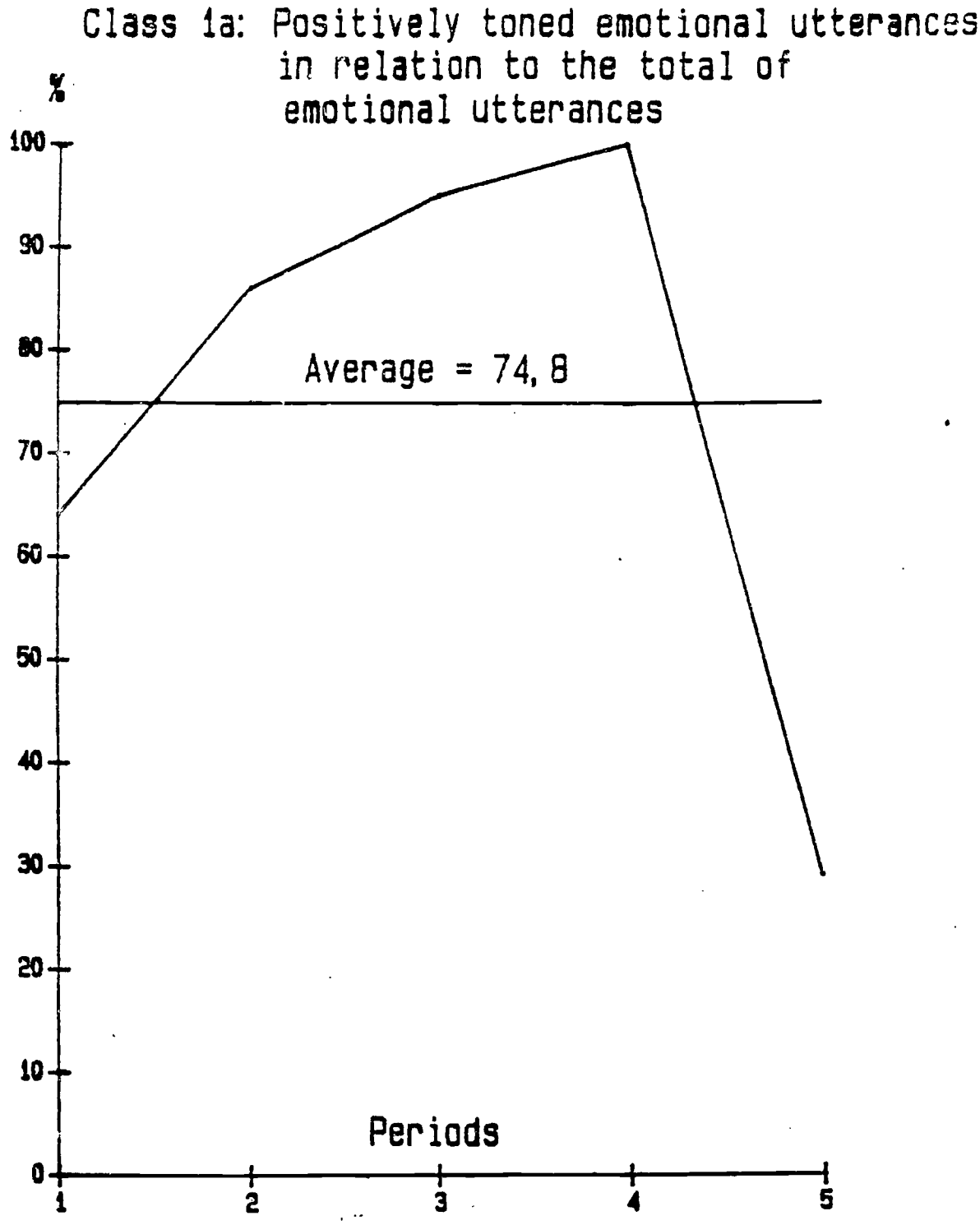


Figure 17: Group 1b: Positively toned emotional utterances in relation to the total of emotional utterances

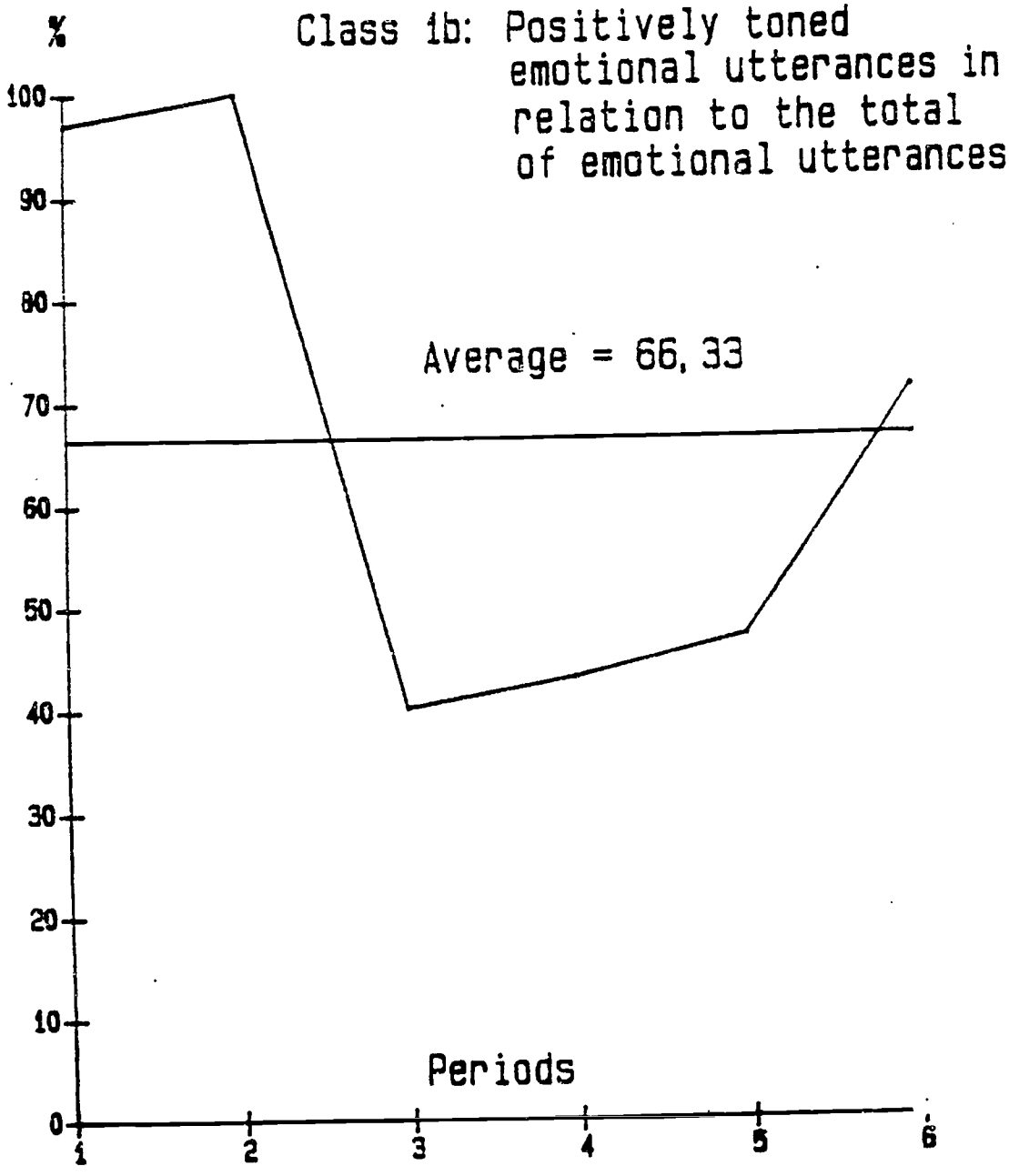


Figure 18: Interview data on cognitive, emotional and motivational effects of a computer-based simulation game

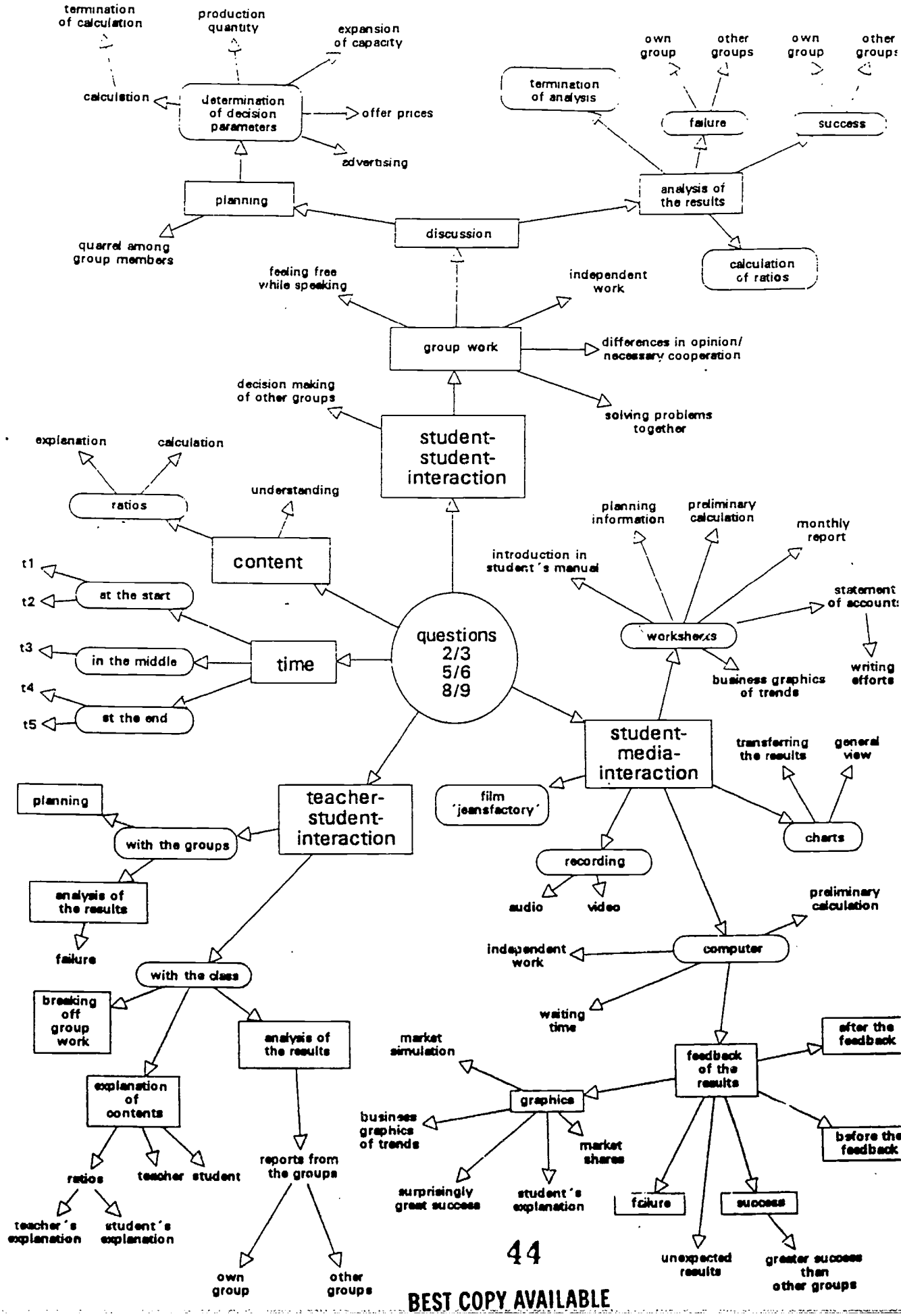


Figure 19: Interview data on the single question: In which situations did you feel well?

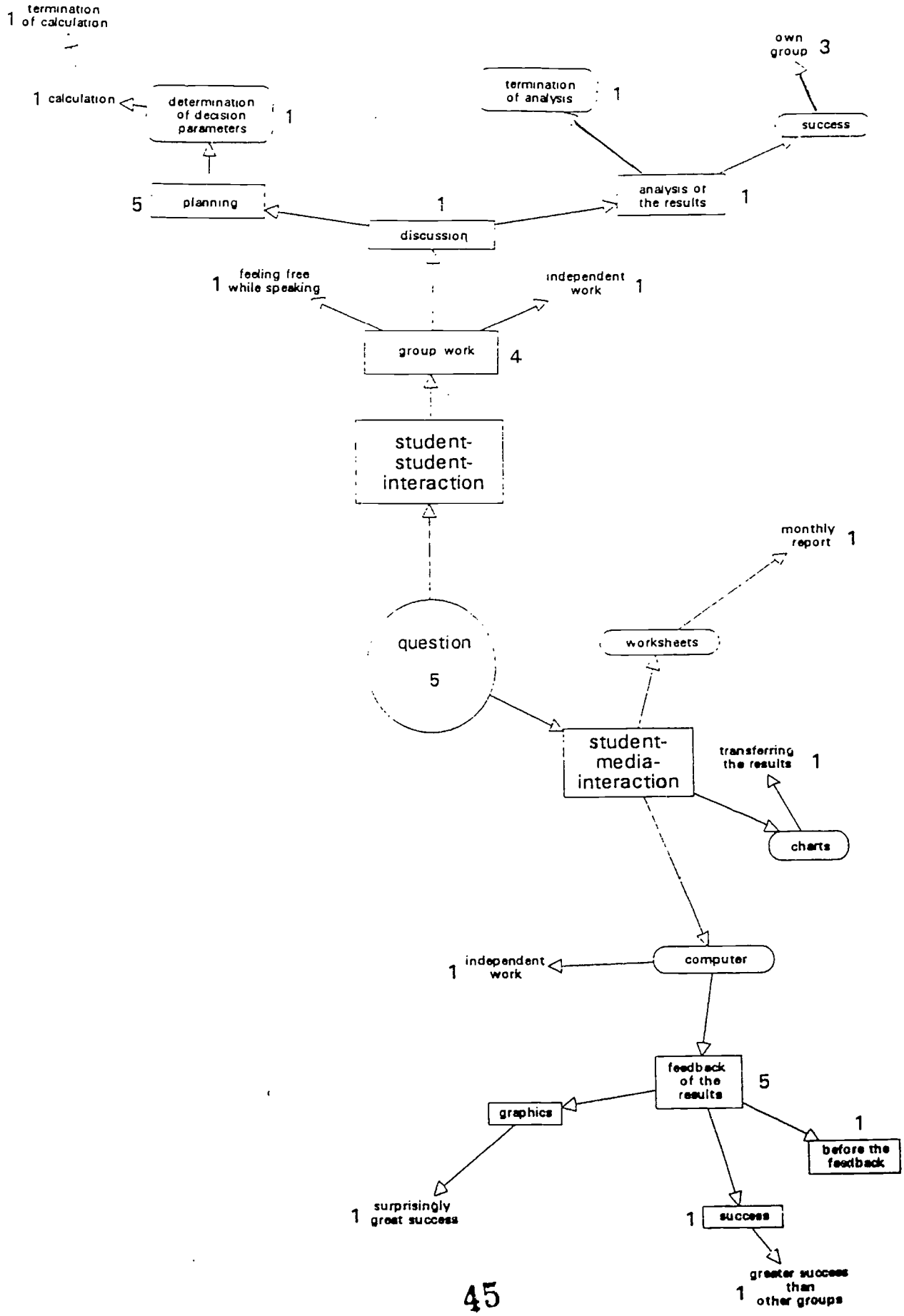


Figure 20: Argumentation structure of a novice

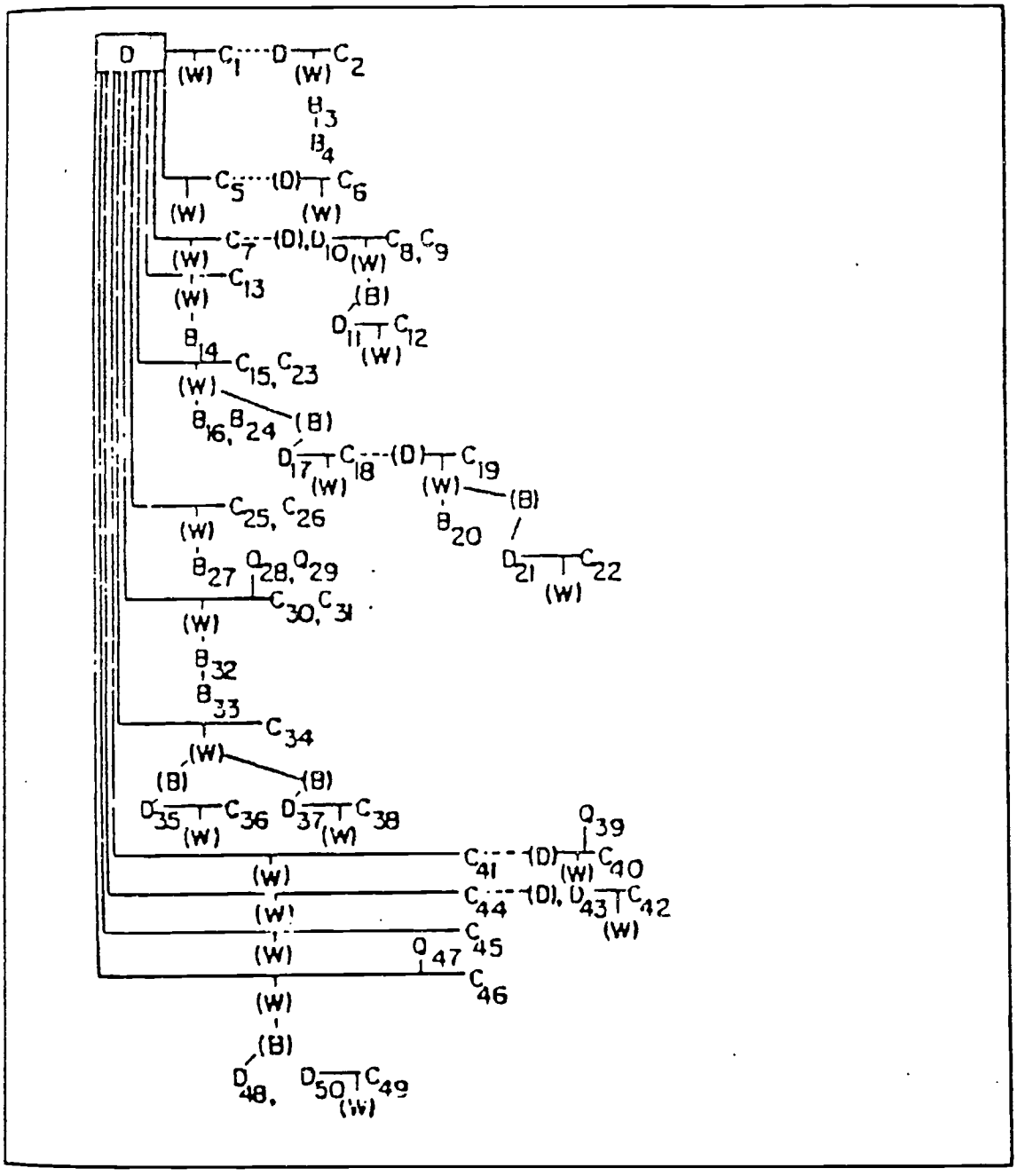
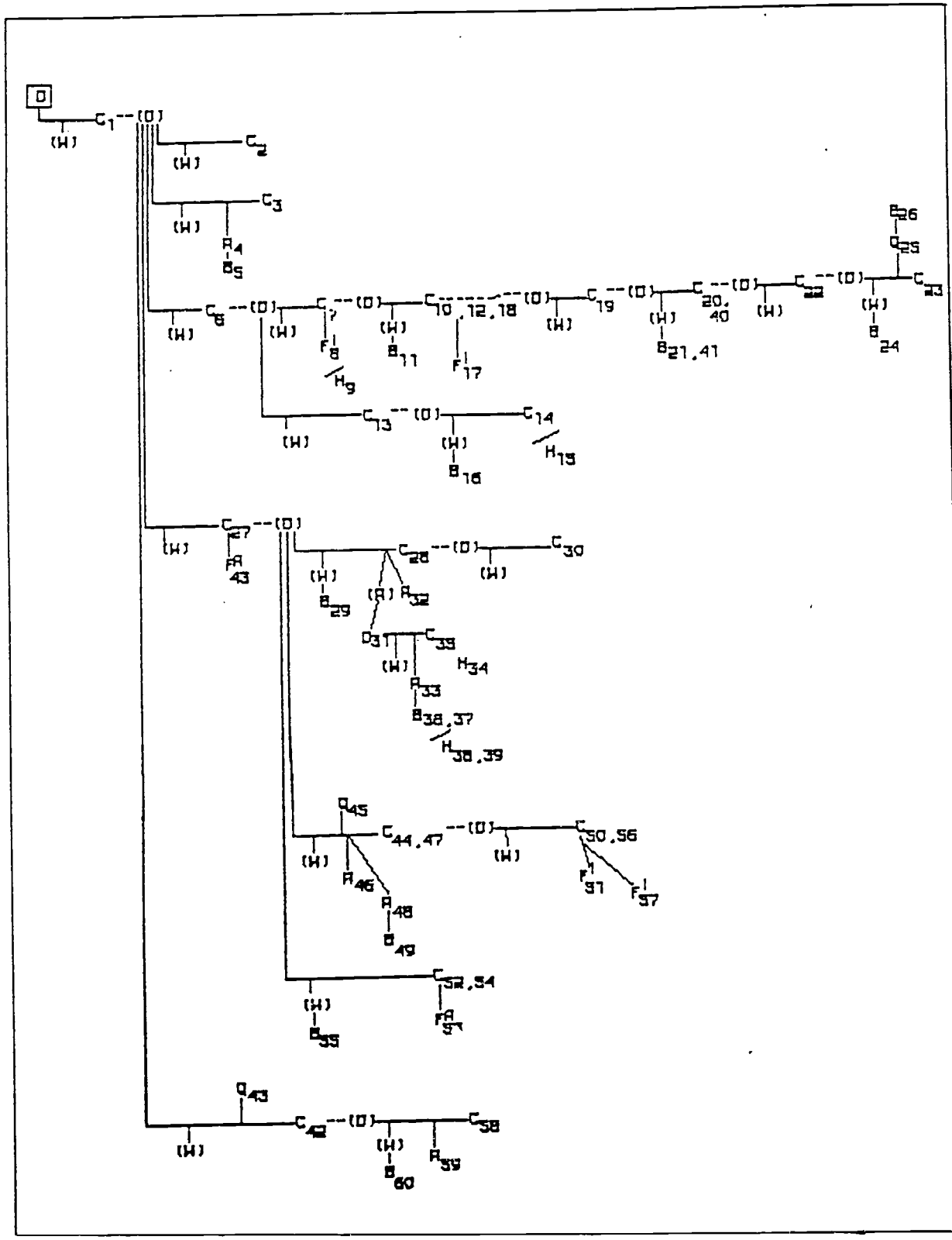


Figure 21: Argumentation structure of a group discussion (experimental class)



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