Quantitative assessment of alternative versus conventional attitudes in higher agricultural education

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ABSTRACT

From radical positions it is argued that it will take paradigmatic transformations to develop a sustainable agriculture and that values and attitudes have to be changed. To find out if teachers and students in higher agricultural education are motivated for radical changes a survey based on the Alternative-Conventional Agriculture Paradigm Scale (ACAP-scale) was conducted. The ACAP-scale shows how people relate to the alternative and conventional agricultural paradigm and it shows their overall understanding of how agriculture works and relates to the physical and social environment. This study showed that the ACAP-scale is a suitable method for quantitative assessment of attitudes to agriculture in a broader context. Among students and faculty members at the Royal Veterinary and Agricultural University, Denmark there exists significant differences in paradigmatic positions. Students' course choices are, to some extent, influenced by their paradigmatic position, some courses enrol followers of either the alternative or the conventional agricultural paradigm, and females and older students hold more alternative views than males and younger students. It is concluded that the wide range of values and attitudes among students and teachers calls for new teaching methods, where values and attitudes are integrated. It cannot be taken for granted that teachers and students share the radical visions of sustainability as sometimes presupposed of bodies working for sustainable development.

INTRODUCTION

It is widely agreed that sustainable development is one of the biggest challenges to universities of the twenty-first century (Huckle & Sterling, 1996; Van de Bor *et al*., 2000; Van Weenen, 2000), even if sustainable development is not an agreed set of ideas, which can be integrated into education in a single or simple manner (Huckle & Sterling, 1996). Governments and organisations repeatedly point to education as a key instrument for facilitating a transition to sustainable development (Huckle, 1996). Education, however, is also looked on as a part of the problem, when universities are considered as institutions deeply involved in current worldwide patterns of unsustainability and institutions that are reluctant to actively pursue efforts towards sustainability (Van Weenen, 2000). In this perspective education cuts both ways.

Consultations of 40 leaders of randomly chosen European universities show that 80% agreed that sustainability is important. Despite this positive attitude, few universities have begun to embed sustainability into their curriculum and campus operation (Perdan *et al*., 2000; Van Weenen, 2000) and hardly any has strategic programmes in place to implement sustainable development into their activities (Filho, 2000). According to Filho (2000), common mentioned barriers are (1) Sustainability is too abstract, broad and distant from reality, (2) There is no personnel to look after it, (3) There is no financial resources to justify it and (4) Sustainability has no scientific basis. Filho (2000) argues that all these barriers are based on misconceptions and attitudinal blockages. Further, he states that there is nothing negative in having different views on the meaning of sustainable development, but without actively persuading some common ground rules and a common discourse, the search for sustainable development is made hopelessly impossible by individual differences in opinions and attitudes.

Sustainable agriculture has met, and meets, similar barriers as sustainable development in higher education, but so far it appears more successful than sustainable development in terms of

integration into higher education (Van de Bor *et al*., 2000). As for sustainable development, there exists no single and agreed definition. The content of the concept is socially constructed and contested. It takes on meaning within different ideologies underpinned by different kinds of knowledge and values. Sustainable agriculture is currently being used to represent everything from organic farming to maximum economic yields (Dunlap *et al*., 1992). From radical positions it is suggested that the ambiguity of sustainability helps the agricultural establishment to express positive values while sanitizing the radical implications of a sustainable agriculture (Dunlap *et al*., 1992). It is argued that it will take paradigmatic transformations to develop a sustainable agriculture through changes in our epistemology and our way of learning (Richards, 1988; Huckle & Sterling, 1996; Francis *et al*., 2000; Lieblein *et al*., 2000; Simon-Brown, 2000). Transformations that involve changes from (1) knowledge and teacher-centred teaching to learning and student-centred teaching, (2) discipline to problem focus, (3) short-term to long-term perspectives, (4) universal principles to site-specific applications and (5) individual learning to interdisciplinary team learning.

Transformations, however, do not come easy and one may ask whether it is possible to develop sustainable agriculture starting from the same values and knowledge paradigm that helped to create our prevailing unsustainable systems? One may ask which paradigms currently prevail in higher agricultural education? Are agricultural faculties and students motivated for radical changes? Are they adherents of strong or weak sustainability?

Beus & Dunlap (1992) investigated paradigmatic positions of agricultural faculty members of Washington State University. They found that faculty members hold slightly more conventional attitudes than state-wide farmers and far more conventional attitudes than alternative agriculturalists. Furthermore, faculty members and farmers conceptualized sustainability rather differently (Dunlap *et al*., 1992). Faculty members tended to emphasize the environmental protection and resource conservation aspects of sustainability, whereas the farmers were more likely

to emphasize the survival and well being of rural communities. This may indicate that the solutions that appeal to agricultural scientists, may neglect socio-economic dimensions of sustainability; in the worst case encouraging technical fixes. Whether agricultural faculties in general hold conventional positions and support narrow technical fixes is not known. To our knowledge European agricultural universities have not been subjects for investigations of paradigmatic positions as regard to sustainable agriculture.

Irrespective of faculty members and students positions, it is certain that education is value driven (Huckle, 1996). Believing that higher education is value-free ignores the tremendous influence of individual options and motivations. Value judgements are made on all levels in education, from choices made to include (or exclude) certain topics to choices made to include (or exclude) new principles for learning.

Values, motivation and learning preferences are interrelated (Garton *et al*., 1997). Students and teachers with conventional values may have learning preferences that differs from that of students and teachers with alternative values. When teachers and students represent conflicting values, conflicts and de-motivation may easily arise. To be able to take account of this in respect to teaching sustainable agriculture, it is useful to quantify attitudes and paradigmatic positions. Such measures may help to adjust curriculum and teaching methods, and help to bring core values into focus as matters of importance in higher agricultural education.

The aims of this study are to determine whether the Alternative-Conventional Agriculture Paradigm Scale (ACAP-scale) developed in America by Beus & Dunlap (1991) in the early nineties still is suitable for quantifying the attitudinal and paradigmatic positions among faculty staff and students at the Royal Veterinarian and Agricultural University, to assess the range of attitudinal and paradigmatic diversity at the university and to determine the relationships between paradigmatic

position, gender, age and course choices. In order to pursue these aims the concepts of internal and external paradigmatic consistency are elaborated.

METHODS

The questionnaire

According to Beus & Dunlap (1990), agricultural paradigms represent collections of attitudes and values that determine people's overall understanding of how agriculture works, how it relates to society and the physical environment, and what types of practices, organizations and institutions they believe are best for agriculture and society. The concept of agricultural paradigms is considerably broader than that of attitude. Divergent paradigms represent fundamental conflicts in world-view.

Beus & Dunlap (1990) identified key elements of the conventional and alternative paradigm of agriculture through content analysis of written work of leading figures in both conventional and alternative agriculture. In both cases, individuals were selected because of wide recognition in their respective agricultural circles, their diverse backgrounds, and because they hold strong views regarding conventional and alternative agriculture. Within alternative agriculture, they included those associated with organic agriculture, sustainable agriculture, regenerative agriculture, eco-agriculture, perma-culture, bio-dynamic agriculture, agro-ecology, natural farming and low-input agriculture. Within conventional agriculture, they included those actively supporting a capital-intensive, large-scale, highly mechanized agriculture with intensive use of artificial fertilizers and pesticides. Several proponents of conventional agriculture were employed in the agrochemical business.

The instrument used in this study to determine paradigmatic positions was a questionnaire designed by Beus & Dunlap (1991) consisting of 24 central items related to alternative and

conventional agriculture. Some items were slightly adjusted to Danish conditions. For each of the 24 items respondents have to choose between two opposite statements representing the alternative or the conventional agricultural paradigm, respectively. The respondents had to choose: (1) strongly agree, (2) agree or (3) neutral or undecided. An example of contrasting statements from the questionnaire is either: "Modern agriculture is a major cause of ecological problems and must be greatly modified to become ecological sound" (alternative statement) or "Modern agriculture is a minor cause of ecological problems and needs to be only fine-tuned periodically in order to be ecologically sound" (conventional statement).

With two bipolar statements for each item and two degrees of agreement and a neutral or undecided position in the middle, a 5- point Likert-scale is created. This Likert-scale is the basis of Beus & Dunlap's (1991) Alternative-Conventional Agriculture Paradigm Scale (ACAP-scale) to measure the paradigmatic position relative to the two competing perspectives on agriculture; the conventional and the alternative. Table 1 shows the key elements identified by Beus & Dunlap (1990) for separation of the paradigms. The questionnaire in Beus & Dunlap (1991) is based on these elements. As shown in Table 1, the competing paradigms may be synthesized into six major dimensions all representing elements of sustainability: (1) centralization versus decentralization, (2) dependence versus independence, (3) competition versus community, (4) domination of nature versus harmony with nature, (5) specialization versus diversity and (6) exploitation versus restraint.

The respondents

The questionnaire was carried out in the spring semester 2001, at the Royal Veterinary and Agricultural University, Copenhagen, Denmark. The respondents of this study were 90 students, 40 faculty members and 10 farmer advisors from The Danish Agricultural Advisory Centre. To ensure a wide range of attitudinal positions, criteria for choosing respondents were (1) the authors'

preconceived expectations about the respondents attitudes towards alternative agriculture, (a) positive attitudes, (b) negative attitudes and (c) unknown and (2) occupation, (a) faculty member, (b) student and (c) adviser for organic farmers.

Students expected to hold positive attitudes to alternative agriculture (Stud-1) consisted of agricultural and horticultural students attending courses in organic agriculture (N=16) (Table 2), students expected to hold negative attitudes to organic farming (Stud-2) consisted of agricultural students attending applied plant production courses (N=22) (Table 2) and students for whom there were no expectations (Stud-ref) consisted of veterinary students and a small group of horticultural students (N=52) (Table 2). Expectations about the student's attitudes were based on the authors' teaching experience from the respective courses. In order to simplify presentation, students were merged into three groups, Stud-1, Stud-2 and Stud-ref, according to attitudes (Table 2).

The faculty members were divided into two groups: Scientific staff including Ph.D.students working in The Organic Farming Unit (N=18), which is a part of Department of Agricultural Sciences (Facu-1), and scientific staff working in other sections within the Department (N=22) (Facu-2). The Organic Farming Unit is responsible for courses in organic farming whereas the rest of the department's course responsibility is plant related disciplines.

The advisors were following a course with a focus on organic farming. Some advisors were full-time advisors for organic farmers whereas others were advisors for organic as well as conventional farmers.

Statistics

Analysis of variance (PROC GLM) and analysis of correlation (PROC CORR) were performed with the SAS-programme (version 8).

RESULTS

Diversity among students and teachers

The Alternative-Conventional Agriculture Paradigm Scale (ACAP-scale) is capable of variations from 24 points to 120 points. Low scores represent endorsement of conventional agriculture and high scores represent endorsement of alternative agriculture. According to Beus & Dunlap (1991), scores in the range of 71-74 indicate typical commitment to the conventional agriculture paradigm and scores in the range of 97-108 indicate typical commitment to the alternative agriculture paradigm. Beus & Dunlap (1991) found that state-wide farmers in Washington State scored 81 indicating that they were more closely committed to the conventional agriculture paradigm than the alternative paradigm.

Scores for each group of respondents in this study are presented in Table 2. There are significant differences among respondent groups ($p < 0.001$). Students who were expected to hold negative attitudes towards organic agriculture (Stud-2) show strong commitment to the conventional paradigm and scored 72 and 68 for each course, respectively, and students who were expected to be positive toward organic farming (Stud-1) show strong commitment to the alternative paradigm or were intermediary positioned between the paradigms and scored 106 and 83 for each course, respectively. The reference student groups (Stud-ref) show intermediary positions and scored 82 and 86 for each course, respectively. The differences between students attending Organic Farming and Crop Husbandry are noteworthy (Table 2). The most alternative positioned student on Crop Husbandry matches the most conventional student on Organic Farming.

On average faculty members' score is a little higher (90) than students (83) ($p < 0.05$). This may not express a general trend at the university, as the respondent populations were small and biased. Advisories were closely related to faculty members as regard to values and attitudes (Table 2).

Age, gender, courses and education

Age influences attitudes among students ($p < 0.05$) but not among faculty members. Older students are more positioned toward the alternative agriculture paradigm. One year adds 0.9 of a score point to the ACAP-scale. Gender influences attitude strongly ($p < 0.001$). Females hold more positive attitudes to alternative agriculture than males. The difference is 12 score points. There is a strong bias between gender and choice of education and courses. Among the veterinary students 79% were females and among students attending courses on organic farming 72% were females whereas 75% of the students who attended the courses in agricultural plant production were males.

Internal consistency

There is no clearly accepted method of analysis for assessing whether the response to a set of items warrants being labelled a paradigm (Beus & Dunlap, 1991). Among others, one standard method is chosen in this study, The Item Correlation Method, where correlations between responses to individual items and the sum of responses to all of the other items are calculated. The average of all correlations expresses the internal consistency. Examples are given in Figure 1 for two items with strong and weak correlations to the ACAP-scale, respectively.

All 24 items-total correlations for the whole study population were significant (data not shown). This indicates that all items constitute a part of the agricultural paradigms. Those items that provide the highest item-total correlations were item L, C, S, W and F according to Beus & Dunlap's (1991) original questionnaire. A high correlation means that the respondents were very consistent about these items in relation to their conventional-alternative paradigmatic position. L is about natural fertilizers and non-chemical pest management versus synthetic fertilizers and pesticides; C is about low versus high energy use in agriculture, S is about imitation of natural

ecosystems versus continued development of advanced technologies that will overcome nature's limits; W is about technology to make farm labour more rewarding and enjoyable versus technology as a substitute of all possible farm labour and F is about recognition and adjustment to limits of what nature can provide versus expanded efforts to develop biotechnologies in order to increase food supplies.

The lowest item-total correlations were for items G, P, T and V. A low correlation means that the respondents were not very consistent about these items in relation to their conventional-alternative paradigmatic position. G is about personal and local experience versus applying of modern agricultural science, P is about growing few crops versus growing diversified crops; T is about specialization in either crops or livestock versus crops and livestock together and V is about farming motivation, money versus lifestyle.

Internal consistency (means of item-total correlations) is presented in Table 3. All values are high and highly significant. This shows that respondents hold consistent views and attitudes and that their views constitute an agricultural paradigm. Their attitudes towards alternative and conventional agriculture are not primary concerned with ecological aspects of agriculture. Attitudes to other issues are strongly interrelated, such as structure of agriculture, i.e., size of farms and number of farms, life-style, culture, rural communities and specialization (Table 1).

High internal consistency indicates strong paradigmatic views. As compared with Beus & Dunlap (1991, 1992), the Danish study groups, in general, hold higher internal consistency. High internal consistency is, in general, related to those who are actively involved in support of one side or the other of the debate. Often adherents of the alternative paradigm show higher internal consistency than adherents of the conventional paradigm (Beus & Dunlap, 1991, 1992). This trend also appeared in this study (Table 3).

External consistency

To determine whether different groups give different priorities to different items, group averages on each item are correlated between groups (Table 4). This correlation expresses the so-called external consistency among groups. From Table 4 it appears that most groups weight individual items behind the ACAP-scale more or less similar. This is illustrated in Figure 2. There are, however, a few exceptions as shown in Figure 3. Veterinary students hold very alternative positions compared to their average ACAP-score in the exploitation versus restraint dimension as compared to faculty members, whereas they hold conventional positions in the specialization versus diversity dimension. Advisors give high priority to the harmony with nature dimension compared to their average ACAP-score (Figure 3).

Comparisons between this study and a 10 years older American study (Beus & Dunlap, 1991) show that the external consistency in the paradigmatic views, are rather consistent over time and geographic/cultural scales. There exists a high degree of external consistency as regard to the alternative paradigm, whereas external consistency in the conventional paradigm is weaker (Table 5). Figure 4 gives examples to show similarities and dissimilarities among the Danish and the American study groups. The American conventional paradigmatic view implies a clear distinction in the view of nature dimension as compared to the Danish groups (Figure 4). The conventional Danish study group (Stud-2) hold relatively more alternative views on nature compared with the conventional American study group (US-con) (Figures 3 and 4).

DISCUSSION

It is often put forward that students in general are losing interest in conventional agriculture and that higher agricultural education should be more focused on alternative agriculture in order to turn the tide of decreasing student enrolments (Lieblein *et al*., 2000; Van de Bor *et al*., 2000). The present

study does not have the power to make generalizations about students' positions at The Royal Veterinarian and Agricultural University, but it has the power to show that at least some student groups at the university are strong believers in conventional agriculture. They are even stronger adherents of conventional agriculture that the American agrochemical business was in the early 1990s.

The study shows that different student groups hold very diverse views on agriculture. Some students clearly prefer courses emphasizing alternative agriculture while others clearly prefer courses ignoring alternative farming. At least some courses enrol followers of either the alternative or the conventional agricultural paradigm.

In this study, male students dominate courses preferred by adherents of conventional agriculture and female students dominate courses preferred by adherents of alternative agriculture. This is in agreement with earlier findings (Beus & Dunlap, 1994; Chiappe & Flora, 1998; Egri, 1999), which shows that males hold more conventional attitudes and behaviours to agriculture than females.

Values and attitudes to agriculture have implications for motivation and learning preferences. Personal values affect attitudes, which in turn affect beliefs, intensions, decisions and actions (Beus & Dunlap, 1994; Allen & Bernhardt, 1995; Osborne & Dyer, 2000). The present study reveals a wide range of values and attitudes among students and faculty members and a link between students' course choices and their views on agriculture. Among students, the ACAP-score varied in the range of 45-119 and among faculty members it varies in the range of 49-119. This variation can be considered both as valuable source in education and as a potential and threatening conflict. It may be a valuable source if values and attitudes are included in a common learning process emphasizing the socially contested nature of education and sustainability. Hereby, it may help people to reflect on different values and realize other worldviews in more informed and

democratic ways. Problems, however, may arise if values are disowned in education, as often recognized in higher agricultural education. When students and teachers try to convince themselves that education is value-free and that the concept of sustainability is a single-value issue, they easily become narrow-focused technocrats unable to understand and act in a complex post-modern society. As indicated by this study, even courses that are supposed to be strictly scientific without supporting any specific values and attitudes such as Plant Production in Agriculture may be associated with strong attitudes supporting a single agricultural paradigm, the conventional.

It should be considered as a clear shortcoming if agricultural students leave universities without knowing that sustainable agriculture is a socially constructed and contested concept involving human values. As a first step in a process where values and attitudes associated with sustainable agriculture are integrated into agricultural education, the ACAP-scale has been found to be useful and easy to handle for non-sociological trained teachers. It is a tool to determine the degree of divergence between alternative and conventional agriculturalists, to identify the elements of the debate over which there is divergence, and to examine the degree to which each camp holds consistent positions across these elements. Furthermore, the results from investigations are easy to communicate across varied agricultural landscapes.

ACAP-scores may also indicate the motivation or lack of motivation for radical changes in education and transitions towards ‘strong’ sustainability (Sterling, 1996), and they may help the respondents to reflect on their own values and attitudes. ACAP-scores may act as a starting point in the discussion about values and attitudes to agriculture. Personally, the authors have realized, that teaching organic agriculture has to be adjusted in accordance to students’ attitudinal positions in order to create motivation and achievements; and that it requires improved skills to teach students about alternative farming if they are adherents to the conventional agricultural paradigm.

CONCLUSIONS

We found that the ACAP-scale can (1) identify key elements of the debate of conventional-alternative farming and quantify the degree of divergence between opponents of conventional and alternative farming, (2) quantify the degree to which each camp holds consistent paradigmatic positions (defined as internal consistency), (3) quantify the degree to which different camps give similar priorities to different items relative to their paradigmatic positions (defined as external consistency), and (4) provide information about values and attitudes to sustainable agriculture which are easy to communicate across varied groups.

By use of the ACAP-scale it was found that (1) values and attitudes among students and faculty members vary significantly, (2) student's course choices are influenced by their paradigmatic position, (3) some courses enrol followers of either the alternative or the conventional agricultural paradigm, (4) females hold more alternative views than males and that (5) older students hold more alternative views that younger students.

It is concluded that the wide range of values and attitudes among students and teachers found in this study calls for teaching methods that make values and attitudes visible in agricultural education and consider human values as both subjects and agents in relation to sustainable agriculture. It cannot be taken for granted that students and faculty members of agricultural universities share the radical visions of sustainability as sometimes presupposed of bodies working for sustainable development.

References

Allen, J.C. & Bernhardt, K. (1995). Farming practices and adherence to an alternative-conventional agricultural paradigm. *Rural Sociology*, **60**, 297-309

Beus, C.E. & Dunlap, R.E. (1990). Conventional versus alternative agriculture: The paradigmatic roots of the debate. *Rural Sociology*, **55**, 590-616

Beus, C.E. & Dunlap, R.E. (1991). Measuring adherence to alternative vs. conventional agricultural paradigms: A proposed scale. *Rural Sociology*, **56**, 432-460

Beus, C.E. & Dunlap, R.E. (1992). The alternative-conventional agriculture debate: Where do agricultural faculty stand? *Rural Sociology*, **57**, 363-380

Beus, C.E. & Dunlap, R.E. (1994). Agricultural paradigms and the practice of agriculture. *Rural Sociology*, **59,** 620-635

Ciappe, M.B. & Flora, C.B. (1998). Gendered elements of the alternative agriculture paradigm. *Rural Sociology*, **63**, 372-393

Dunlap, R.E., Beus, C.E., Howell, R.E. & Waud, J. (1992). What is sustainable agriculture? An empirical examination of faculty and farmer definitions. *Journal of Sustainable Agriculture*, **3(**1), 5-39

Egri, C.P. (1999). Attitudes, backgrounds and information preferences of Canadian organic and conventional farmers: Implications for organic farming advocacy and extension. *Journal of Sustainable Agriculture*, **13**(3), 45-72

Filho, W.L. (2000). Dealing with misconceptions on the concept of sustainability. *International Journal of Sustainability in Higher Education*, **1**, 9-19

Francis, C.A., Lieblein, G., Helenius, J., Salomonsson, L., Olsen, H. & Porter, J. (2001). Challenges in designing ecological agriculture education: A Nordic perspective on change. *American Journal of Alternative Agriculture*, **16**(2), 89-95

Garton, B.L.; Thompson, G.W. & Cono, J. (1997). Agriculture teachers and students: In concert or conflict? *Journal of Agriculture Education*, **38**(1), 38-45

Huckle, J. (1996). Realizing sustainability in changing times. *Education for Sustainability*. (J. Huckle & S. Sterling, eds.), pp.3-17. Earthscan Publications Ltd; London, U.K.

Huckle, J. & Sterling, S. (1996). *Education for Sustainability*. Earthscan Publications Ltd; London. U.K.

Lieblein, G., Francis, C. & King, J. (2000). Conceptual framework for structuring future agricultural colleges and universities in industrial countries. *The Journal of Agricultural Education and Extension*, **6**, 213-222

Osborne, E.W. & Dyer, J.E. (2000). Attitudes of Illinois agriscience students and their parents toward agriculture and agricultural educations programs. *Journal of Agricultural Education*, **41**(3), 50-59

Perdan, S., Azapagic, A. & Clift, R. (2000). Teaching sustainable development of engineering students. *International Journal of Sustainability in Higher Education*, **1**, 267-279

Richards, S.A. (1988). Higher education for an alternative agriculture: British universities and the need for reform. *Biological Agriculture & Horticulture*, **5**, 347-364

Simon-Brown, V. (2000). Sustainable living. Strategies for breaking the cycle of work and spend. *International Journal of Sustainability in Higher Education*, **1**, 290-296

Sterling, S. (1996). Education in change. *Education for Sustainability*. (J. Huckle & S. Sterling, eds.), pp.18-39. Earthscan Publications Ltd; London, U.K.

Van de Bor, W., Holen, P., Wals, A. & Filho, W.L. (2000). *Integrating Concepts of Sustainability into Education for Agriculture and Rural Development*. Peter Lang; Frankfurt am Main, Germany

Van Weenen, H. (2000). Towards a vision of a sustainable university. *International Journal of Sustainability in Higher Education*, **1,** 20-34

TABLE 1

Key issues of the questionnaire. The 24-items questionnaire used in this study is given in Beus & Dunlap (1991).

Conventional agriculture paradigm	Alternative agriculture paradigm
Dependence	**Independence**
• Large, capital-intensive production units and technology	• Smaller, low-capital production units and technology
• Heavy reliance on external sources of energy, inputs, and credit.	• Reduced reliance on external sources of energy, inputs, and credit
• Consumerism and dependence on the market	• More personal and community self-sufficiency
• Primary emphasis on science, specialists and experts	• Primary emphasis on personal knowledge, skills, and local wisdom
Centralization	**Decentralization**
• National, international production, processing and marketing	• More local/regional production processing and marketing
• Concentrated populations; fewer farmers	• Dispersed populations; more farmers.
• Concentrated control of land, resources and capital	• Dispersed control of land, resources, and capital
Competition	**Community**
• Lack of cooperation; self-interest	• Increased cooperation
• Farm traditions and rural culture outdated	• Preservation of farm traditions and rural culture
• Small rural communities not necessary to agriculture	• Small communities essential to agriculture
• Farm work a drudgery; labour and input minimized	• Farm work rewarding; labour essential to be made meaningful
• Farming a business only	• Farming a way of life as well as a business.
• Primary emphasis on speed, quantity, and profit	• Primary emphasis on permanence, quality, and beauty
Domination of nature	**Harmony with nature**
• Humans are separate from and superior to nature	• Humans are part of and subject to nature
• Nature consists primarily of resources to be used	• Nature is valued primarily for its own sake
• Life-cycle incomplete; decay (recycling wastes neglected)	• Life-cycle complete; growth and decay balanced
• Human-made systems imposed on nature	• Natural ecosystems are imitated
• Production maintained by agricultural chemicals	• Production maintained by development of healthy soil
• Highly processed, nutrient-fortified food	• Minimally processed, naturally nutritious food

TABLE 1

Continued.

Conventional agriculture paradigm	Alternative agriculture paradigm
Specialization • Narrow genetic base • Most plants grown in monocultures • Single-cropping in succession • Separation of crops and livestock • Highly specialized, reductionistic science and technology	**Diversity** • Broad genetic base • More plants grown in poly-culture. • Multiple crops in complementary rotations • Integration of crops and livestock • Locally adapted production systems
Exploitation • External costs often ignored • Short-term benefits outweigh long-term consequences • Based on heavy use of non-renewable resources • Great confidence in science and technology • High consumption to maintain economic growth • Financial success; busy lifestyles; materialism	**Restraint** • All external costs must be considered • Short-term and long-term outcomes equally important • Based on renewable resources; non-renewable resources conserved • Limited confidence in science and technology • Consumption restrained to benefit future generations • Self-discovery; simpler lifestyles; non-materialism

TABLE 2

ACAP-scores for respondent groups.

Respondent groups	N	Merged respondents groups in further analyses	ACAP score* (range)
Agricultural and/or horticultural students following course in			
• Organic Farming	7	Stud-1	106[a] (87-119)
• Introduction to Organic Farming	9	Stud-1	83[bc] (63-107)
• Plant production in agriculture	7	Stud-2	72[cd] (57-91)
• Crop Husbandry	15	Stud-2	68[d] (45-88)
• Advance horticulture	7	Stud-ref	82[bc] (77-91)
Veterinarian students following a course in			
• Special pathology	45	Stud-ref	86[b] (68-114)
Faculty staff			
• Organic Farming Unit	18	Facu-1	95[b] (54-119)
• The rest of the Department of Agricultural Sciences	22	Facu-2	86[b] (49-115)
Farmer advisors	10	Advisor	91[b] (78-104)
Total	140		85 (45-119)

*Letters attached to ACAP-score show statistic difference at $p < 0.05$ according to Duncan multiple range test

TABLE 3

Internal consistency of agricultural paradigms (mean of all correlations between individual items and the ACAP-score - see text for further explanation). Group identification according to Table 2.

Group	Total ACAP-score	Internal consistency
Facu-1	95	0.67
Facu-2	86	0.52
Stud-1	94	0.67
Stud-2	69	0.49
Stud-ref	86	0.38
Advisors	91	0.53

TABLE 4

External consistency of agricultural paradigms (correlations between item scores from different groups - see text for further explanation). Group identification according to Table 2.

	Facu-2	Stud-1	Stud-2	Stud-ref	Advisor
Facu-1	0.713***	0.728***	0.664***	0.504*	0.506*
Facu-2		0.684***	0.570***	0.699***	0.627***
Stud-1			0.636***	0.762***	0.806***
Stud-2				0.443**	0.443*
Stud-ref					0.750***

Significant at * $p < 0.05$; ** $p<0.01$; *** $p<0.001$.

TABLE 5

External consistency of agricultural paradigms (correlations between item scores from different groups) between study groups separated in time (10 years) and geography (Europe versus USA). US-data is from Beus & Dunlap (1991). Group identification according to Table 2.

	Facu-1	Facu-2	Stud-1	Stud-2	Stud-ref	Advisor
US-Alternative (ACAP-score: 102)	0.721***	0.777***	0.758***	0.558***	0.776***	0.644***
US-Conventional (ACAP-score: 73)	0.352NS	0.372NS	0.263NS	0.558**	0.221 NS	0.010 NS

NS not statistical significant; ** $p < 0.01$; *** $p < 0.001$

FIGURE 1. Relationships between ACAP-scores and single item scores for students expected to positive towards organic farming (Stud-1) and students expected to be positive towards conventional farming (Stud-2). Upper figure shows an item with a strong coherence to the ACAP-score. Lower figure shows an item with a weak coherence to the ACAP-score. Item F: Alternative position: Agricultural scientists and policy-makers should recognize that there are limits to what nature can provide and adjust their expectations accordingly. Conventional position: Agricultural scientists and policymakers should expand efforts to develop biotechnologies and other innovations in order to increase food supplies. Item G: Alternative position: Good farming depends mainly on personal experience and knowledge of the land. Conventional position: Good farming depends mainly on applying the findings of modern agricultural science. Item letters according to Beus & Dunlap (1991).

FIGURE 2. Examples of high external consistency between study groups. Upper figure shows faculty members working with organic farming (Facu-1) and faculty members working with plant science in general (Facu-2). Lower figure shows students expected to positive towards organic farming (Stud-1) and students expected to be positive towards conventional farming (Stud-2). Item scores grouped in six major dimensions according to Table 1. DECEN denotes the centralization versus decentralization, HARMO denotes domination of nature versus harmony with nature, COMM denotes competition versus community, DIVER denotes specialization versus diversity, INDEP denotes dependence versus independence and RESTR denotes exploitation versus restraint.

FIGURE 3. Examples of low external consistency between study groups. Upper figure shows students for whom there were no expectations about attitudes (Stud-ref) and students expected to be positive towards conventional farming (Stud-2). Lower figure shows faculty members working with

organic farming (Facu-1) and organic farmer advisors (Advisor). Item scores grouped in six major dimensions according to Table 1. Dimension abbreviations as in Figure 2.

FIGURE 4. Examples of low (upper figure) and high external consistency (lower figure) between the current Danish study groups and US-groups. Stud-ref denotes students for whom there were no expectations about attitudes, Facu-2 denotes faculty members working with plant science, US-con and US-alt denote conventional and alternative groups in a 10 years old US-study published by Beus & Dunlap (1991). Item scores grouped in six major dimensions according to Table 1. Dimension abbreviations as in Figure 2.

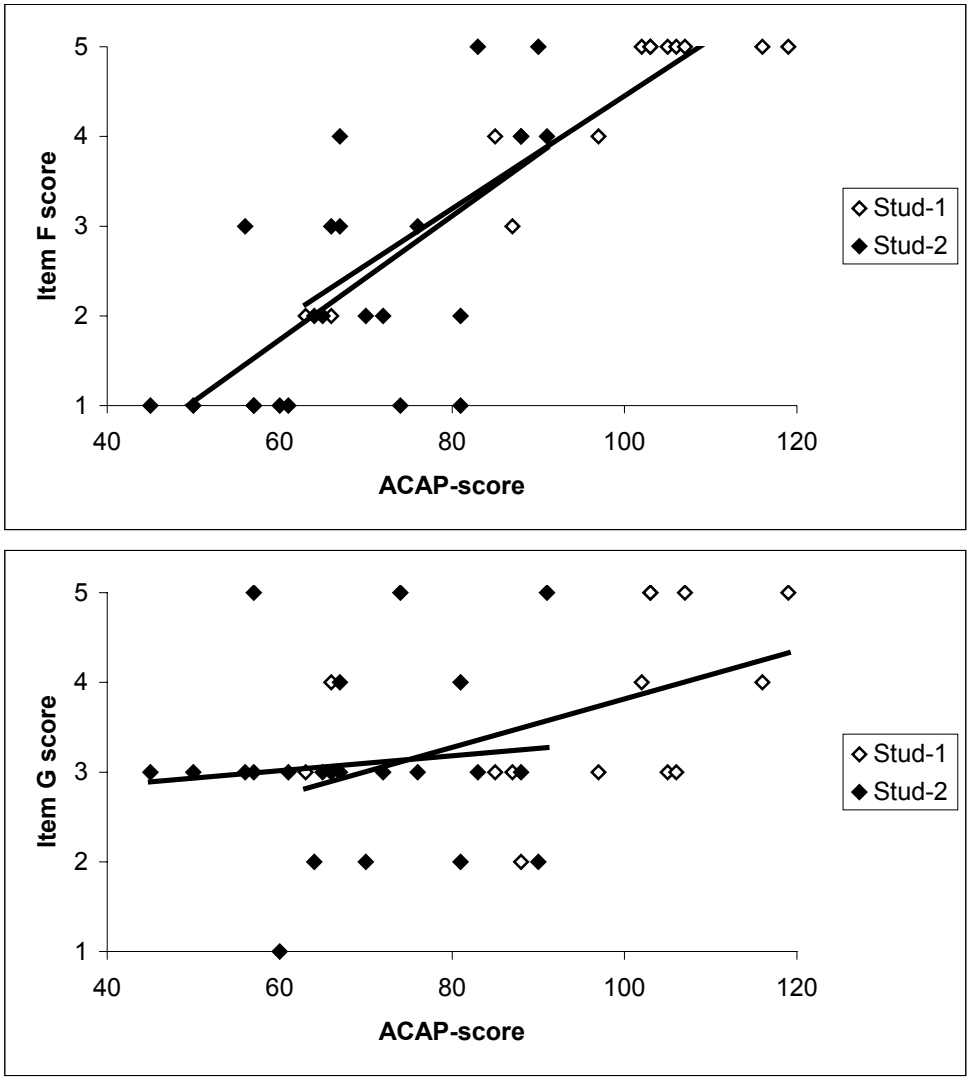
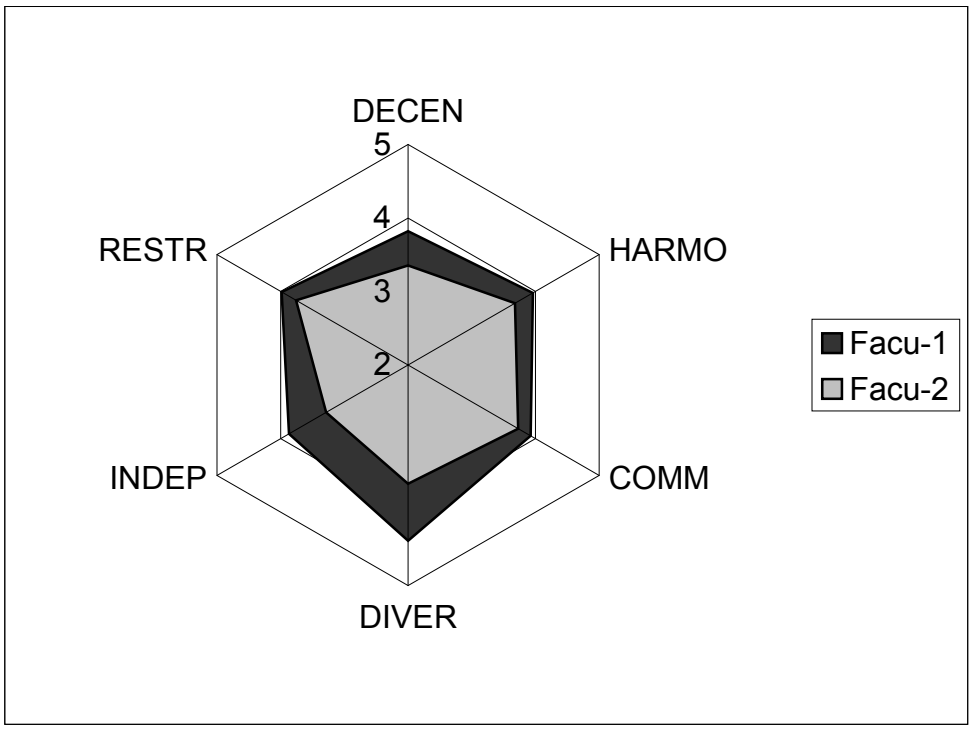

Item F score
ACAP-score
Stud-1
Stud-2
Item G score
ACAP-score
Stud-1
Stud-2

Figure 1


DECEN
5
4
3
2
HARMO
COMM
DIVER
INDEP
RESTR
Facu-1
Facu-2

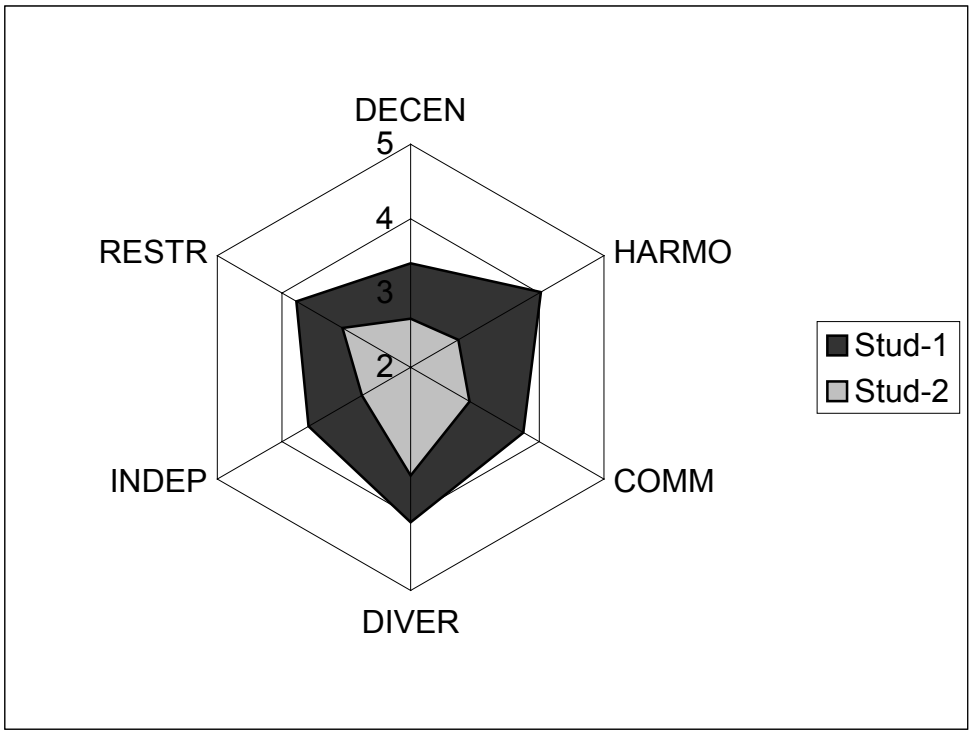
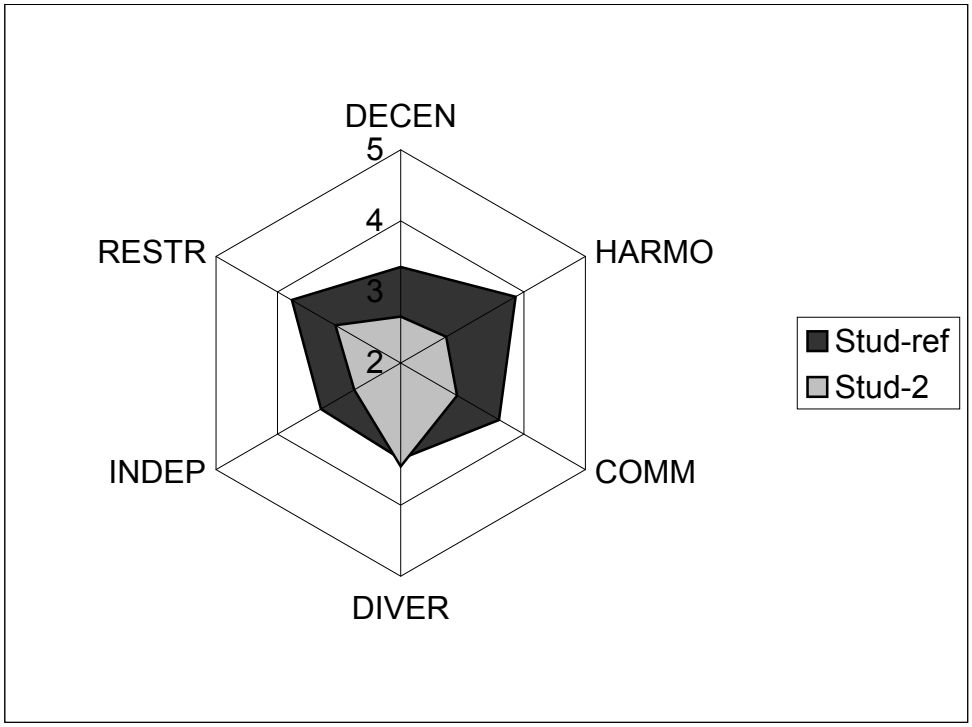

DECEN
5
4
3
2
HARMO
COMM
DIVER
INDEP
RESTR
Stud-1
Stud-2

Figure 2


DECEN
5
4
3
2
RESTR
HARMO
INDEP
COMM
DIVER
Stud-ref
Stud-2

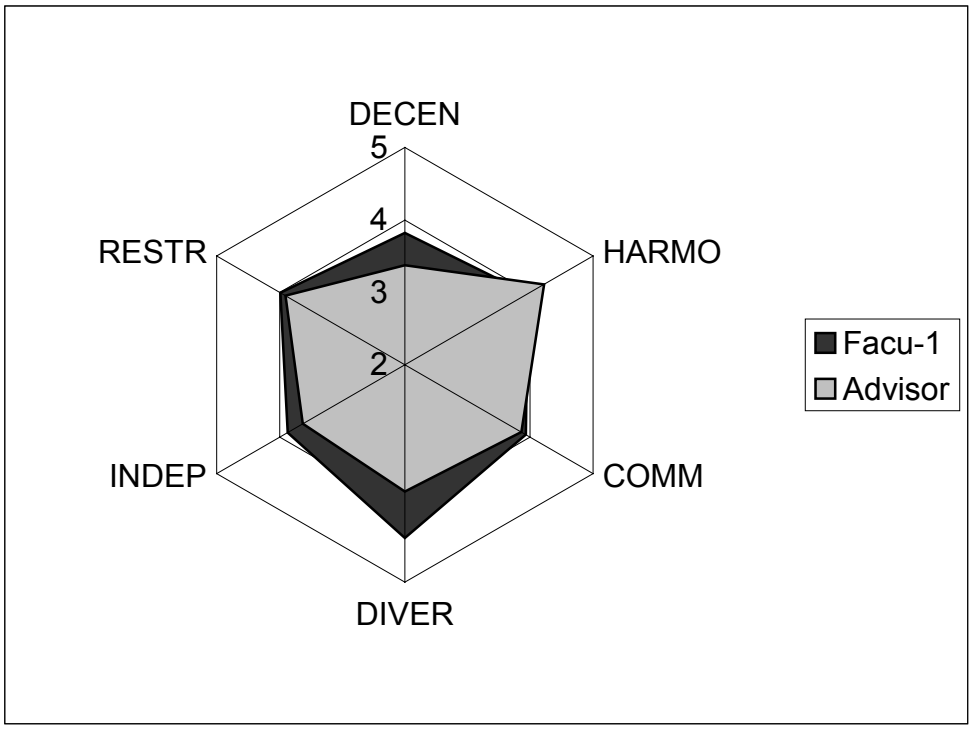
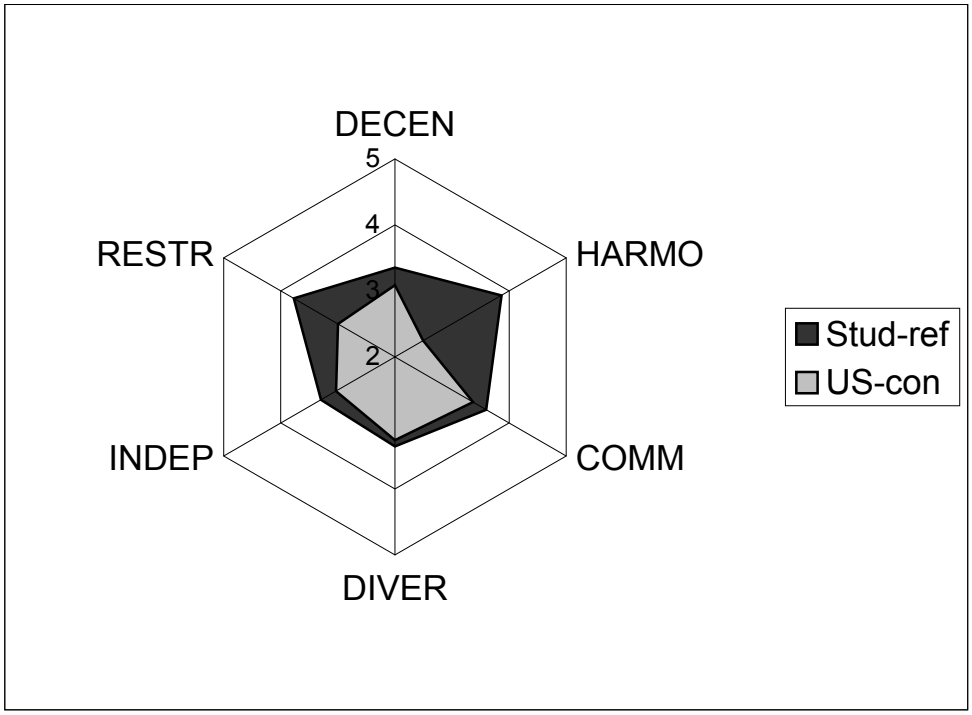

DECEN
5
4
3
2
RESTR
HARMO
INDEP
COMM
DIVER
Facu-1
Advisor

Figure 3


DECEN
5
4
3
2
RESTR
HARMO
INDEP
COMM
DIVER
Stud-ref
US-con

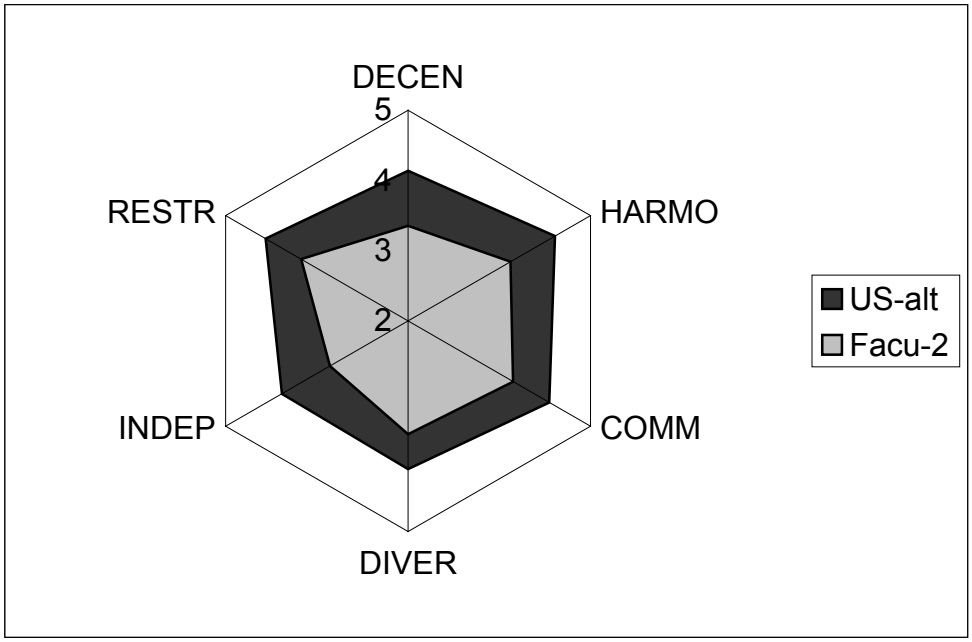

DECEN
5
4
3
2
RESTR
HARMO
INDEP
COMM
DIVER
US-alt
Facu-2

Figure 4