Vol 5, No. 2, May 2009, pp. 85-103

Reflecting Education
http://reflectingeducation.net

Student team formation based on learning styles at university start: Does it make a difference to the students?

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ABSTRACT

This paper presents the design, implementation, and evaluation of a process of team formation based on learning styles profiles. At admittance to Copenhagen Business School 124 BSc students (Business Economics/Psychology) completed the Danish Self-Assessment Learning Styles Inventory (Nielsen, 2005a) based on Sternberg's Theory of Mental Self-Government (Sternberg, 1997). A set of criteria for team formation was designed with "differentiation" of learning styles as the overall strategy. At the start of the first term and in connection with a course in Psychological Testing, students were informed about the team-formation criteria and the resulting teams, and were given a lecture on learning styles and their possible uses. In addition, students were given their personal learning styles profile and materials for interpretation. At the end of the semester, an internet-based evaluation survey on the students' uses of and benefits from the learning styles tools and team formation during the term (n = 96, 77%) was conducted. Two focus group interviews were conducted to elaborate on the survey results (n = 10). Analyses showed that students used the learning styles profiles and benefitted from the group-formation process in a number of different ways: (1) as a tool for understanding personal learning processes and how they relate to others in learning situations, and (2) individual profiles were shared and discussed in the majority of teams. Some of the benefits from the team-formation process were: (1) a sense of improved understanding of the learning processes of co-students and co-team members; (2) a feeling of improved preparedness learning wise for their university study; and (3) improved teamwork competency. In addition, a number of students in the open comments and focus groups emphasised that the group-formation process had facilitated: (1) a more professional approach to the teamwork, with longer and more differentiated discussions on subjects, content and assignments, and (2) a greater degree of tolerance of differences than they usually showed towards team members, thereby avoiding conflicts that would have arisen if teams had not been formed professionally. Overall, this conscious process of team composition based on learning style profiles gave students insights into the strengths and weaknesses of their profile and how this related to teamwork as well as first hand experience of "being on the client/receiver end" of the different processes involved in psychological testing, test feedback, and group formation. It is very important to stress that this method of team formation requires very careful consideration and should not be implemented uncritically; there needs to be a clear rationale and coherence between aims and means.

Key words: Learning styles, student team formation, higher education.

 ISSN 1746-9082

INTRODUCTION

Teamwork and team learning have in recent years become more common in a wide range of occupations and organisational settings and are still growing (Loughry et al., 2007; Wilson et al., 2007). Accordingly, research on teams and groups in organisational settings has also increased (Bettenhausen 1991; Cohen & Bailey 1997; Mathieu et al., 2008). To prepare students at higher education institutions for workgroups and teamwork, we argue that students within a vast range of fields and disciplines would benefit from teaching focused on individual learning, team processes and team formation as well as from training in teamwork and team learning, in the sense that the resulting knowledge, experiences, skills, and competencies would prepare them for the teamwork they will encounter in their careers. This is even more the case for students from disciplines aimed at employment in areas such as teaching, human resources management, testing and so on, where the candidates would be expected not only to undertake teamwork themselves but also to be able to organise, facilitate and support teamwork and learning processes from other people.

Since the start of the Bachelor Degree Programme in Business Economics and Psychology at Copenhagen Business School in 2004, emphasis has been placed on the development of such team competencies and skills. For this purpose, each of the first three terms included formation of student teams based on individual completion of different tests and with a growing degree of student influence in the actual team formation. During those years common feedback from students was that the team formation lacked meaning for the students, because it was an isolated event during the first three terms and was not directly connected to any of the courses they took during this period. At the same time a need for a course on psychological testing was expressed. Together these two "needs" gave rise to the design of a new three-term course in Psychological Testing, which would provide a connection to the tests used for team formation.

The basic idea of connecting the team-formation processes during the first three terms of the programme with the course in Psychological Testing was that these two entities could then mutually enhance the meaningfulness of both for the students. The team-formation process would, on the one hand, feed into the course on Psychological Testing by providing the students with first-hand experience (inductive learning) with regard to being on the receiver/client end of psychological testing, which would complement and provide perspectives on the theoretical part of the course. The course on Psychological Testing would, on the other hand, feed into the team-formation process by adding an external and subject related purpose and thereby additional meaning to this process.

The main purpose of this study was to evaluate the designed process of team formation based on the students' learning styles with regard to the degree of student satisfaction and with regard to the ways the students benefitted from this process. First, we argue for the relevance of using learning styles as a basis for team formation, and we argue for and present the team-formation criteria employed in the study. Secondly, we describe the process of team formation and evaluation of this process as a whole, and describe the participants, instruments and analyses employed. Thirdly, we report the result of the evaluation of the team-formation process as well the students' self-perceived individual and

collective benefits from this process. Finally, we briefly discuss the findings in relation to existing literature on group and team formation with a particular emphasis on the issues of whether homogeneous or heterogeneous teams are preferable, as well as the question of connections between the team and the learning literature.

THEORETICAL BACKGROUND AND RATIONALE FOR USING LEARNING STYLES AS A BASIS FOR TEAM FORMATION

The Bachelor of Business Economics and Psychology Degree Programme held the *a priori* criteria for the team formation that student work teams for the first term should be made up of five students each. On this basis, we wanted to form teams in a way that would enhance group dynamics in terms of having students with different preferences for thinking when learning and problem solving in each team, so that discussions on how to approach, solve and deliver assignments and tasks, would be enhanced in the teams. Although studies of the effects of diversity on performance are mixed with regards to most diversity dimensions (Cohen & Bailey 1997; Jackson et al., 2003), some studies have shown that functional/occupational diversity improves at least some types of performance, such as innovation and creativity (Jackson et al., 2003; Rentsch & Hall 1994). In this study, we focused on diversity as creating differences in thinking and we contemplated that this would:

1. give the students a genuine simulation of teamwork in organisations, where you will be required to work with people thinking in different ways to yourself (e.g. inductive learning), thereby facilitating the development of teamwork competencies and skills;
2. help to ensure a more all-round approach to the tasks at hand, thereby possibly raising the quality of the team products (Drach-Zahavy & Somech, 2001);
3. facilitate understanding of and tolerance towards the thinking of fellow students, much in the same way as has been reported for teachers (Nielsen, 2008a);
4. attempt to "install" a certain balance between toil and exuberance in the team learning situations for the individual student (Hermansen, 2005). Toil in the sense that it was considered more challenging to work with people preferring to think in different ways than yourself, and exuberance in the sense of discovering that people with different preferences for thinking could enhance your own thinking and the products thereof.

In summary, we propose, in accordance with Drach-Zahavy and Somech (2001), that team learning will increase as a consequence of diversity in preferences for thinking and the resulting diversity in approaches to tasks etc.

The overall aim to facilitate discussions on how to approach, solve and deliver assignments and tasks in the teams by differentiation in preferences for thinking when learning could be successfully achieved by differentiation according to learning styles, since the concept of learning styles in some of the broader definitions reflect exactly such individual differences – for example Kolb's (1984) four learning styles and the 14 learning styles in the Danish adaptation of Sternberg's (1988; 1997) theory of mental self-government (see Nielsen, 2005a; 2005b; Nielsen et al., 2007). Our choice of the Danish adaptation of the theory of mental self-government as the theoretical framework and the Danish Self-Assessment

Learning Styles Inventory (D-SA-LSI) as the instrument for this study was based on two major considerations: The first being that the definition of learning styles within this theoretical framework would facilitate our aims, as stated above and as follows from the definition of learning styles within this theory. The second being that the D-SA-LSI had been adapted and developed specifically for use with Danish university students.

Sternberg's theory of mental self-government is still a relatively 'young' theory of styles and has not been employed to any significant extent within the European educational context. And in particular, the theory has not been used for research into student team formation. This study, is an example of an exploratory study, and should be regarded as such. The Danish adaptation of Sternberg's theory and the D-SA-LSI is more recent than Sternberg's original theory having only been applied to one other study (Nielsen, 2008a), but applied higher education research in Europe and in particular in Denmark based on this adaptation is growing in education, medical as well as business settings. Such research is important in that it may be possible to establish this theoretical framework as a pedagogically and didactically useful one.

In the Danish adaptation of the theory of mental self-government (Nielsen, 2005a, 2005b; Nielsen et al., 2007), learning styles are defined as:

> A profile of thinking styles describing how the individual prefers to think (preferences for different cognitive processes) in learning situations in a specific context (here the university study) (Nielsen, 2005b).

These preferred ways of thinking represent different ways of perceiving and handling different types of problems in the learning context. That is, an individual with a certain learning style will perceive tasks that he/she encounters when learning as a certain type of problem and will, as a consequence of their perception of the nature of the specific problem – whether real or perceived – choose to handle them in certain ways (Sternberg, 1997). In addition, learning styles, in this framework, are proposed to be context-specific, socialised and teachable (Sternberg, 1988; 1997; Nielsen, 2005b; Nielsen et al., 2007).

The Danish adaptation of the theory of mental self-government comprises 14 learning styles (see Table 1 and Appendix A for description), and it is important to emphasise that all 14 styles are *always* represented in each individual learning styles profile, but to varying degrees. For example, the "level" of mental self-government is not a question of preference for either global ways of thinking or local ways of thinking; rather it is a question of degrees of preference for global *and* local ways of thinking. The preferences *for* certain ways of thinking can therefore (and will usually) be of differing strengths, but never entirely absent (Nielsen, 2005b; Sternberg, 1997).

Functions	Forms	Levels	Scopes	Leanings
Legislative	Monarchic	Global	Internal	Conservative
Executive	Hierarchic	Local	External	Liberal
Judicial	Oligarchic			
	Anarchic			
	Democratic			

Table 1: The 14 learning styles in the Danish adaptation of the theory of mental self-government

The specific set of team-formation criteria employed in the present study was mainly inspired by the theoretical proposals of Zhang (2003) and Zhang and Sternberg (2005; 2006) who stated that the 13 thinking styles within the original theory of mental self-government (Sternberg, 1988; 1997) can be divided into three distinct types of styles. The 14th style, the Democratic style, which is proposed as an addition to the Danish adaptation of the theory of mental self-government (Nielsen et al., 2007), can also be placed within this typology (see also Appendix A). Accordingly:

- Type I thinking styles are the styles reflecting a preference for the unstructured, the cognitively complex, the non-conforming and for autonomy. These styles are referred to as *creative styles*. The type I styles are the Legislative, Judicial, Hierarchic, Global and Progressive[i] styles;
- Type II thinking styles are the styles reflecting a preference for the structured, the cognitively simple, the conforming and the authoritative. These styles are also referred to as *analytical styles*. The type II styles are the Executive, Monarchic, Local and Conservative styles;
- Type III thinking styles differ from the two other types of styles in that they depend on the demands of a given task and the individual's personal interest in it, and they may therefore produce a degree of preference corresponding to those connected to types I and II mentioned above (for a short summary, see Nielsen, 2008b). These styles are also referred to as *performance and socially oriented styles*. The type III styles are the Oligarchic, Anarchic, Internal and External styles. In line with the descriptions of the three types of styles, the fourteenth style in the D-SA-LSI, the Democratic learning style (Nielsen et al., 2007), is proposed to be a type III style.

Differentiation as the overall strategy for the team formation could then be expressed as a strategy ensuring that all of the three types of learning styles outlined should be represented in each team to ensure differing degrees of preferences for structure, cognitive complexity, conformity and management/control. However, in addition to this broad definition of differentiation, we also wanted a more specific learning style differentiation in order to enhance further team dynamics and breadth in approaches to learning, problem solving, etc. Accordingly, a set of five criteria for team formation on the basis of individual learning styles profiles was designed so that the teams would consist of students with different learning styles (i.e., preferences for thinking when learning). The five team-formation criteria were applied in the order listed below, with the first criterion being the most important, and the remaining four criteria being applied if possible and in the given order of priority.

Criterion 1 (the functional styles): The *Legislative*, the *Executive* and the *Judicial* learning styles should each be represented in the team by students with a *strong* or *very strong* score[ii] on these. In addition, each team should not have more than two students with a *strong* or *very* strong Legislative learning style. This criterion ensures that teams will have students with strong type I styles and students with strong type II styles, which facilitates diversity in overall problem approach (deciding – doing – evaluating) and minimises conflicts about leadership/decision making/ideas in the teams.

Criterion 2 (the level styles): The *Global* and the *Local* learning styles should each be represented in the team either 1) with a three/two distribution of students with a *strong* or *very strong* score on the two styles, or 2) with students that are balanced with regard to the two styles (that is equal score on both). This criterion ensures that teams will have students with strong type I styles and students with strong type II styles, which facilitates both detailed and abstract level in the teamwork.

Criterion 3 (the leaning styles): The *Conservative* and the *Progressive* learning styles should both be represented in the team by students scoring *medium strong or higher* on these styles. This criterion ensures that teams will have students with strong type I styles and students with strong type II styles, which facilitates use of both known and new materials and methods in the teamwork.

Criterion 4 (the scope styles): The *Internal* learning style should be represented in the team with at least one and preferably two students scoring *medium strong or higher* on this style. This criterion ensures that teams will have students with strong type III styles, which facilitates inwards as well as outwards reference in the team's work towards solutions.

Criterion 5 (the form styles): The *Monarchic*, the *Oligarchic* or the *Anarchic* learning styles should be represented in the team by no more than two students scoring *medium strong or higher* on these styles. This criterion ensures that teams will *not* have a majority of students who are strong on these type I and type III styles, and prevents dominance of certain types of problem perception (over-simplifying – making over-complex – systematic - random).

METHODS

Design of the team-formation process and evaluation

The single elements in the team-formation process were:

- In the welcoming letter to the Bachelor of Business Economics and Psychology Programme at Copenhagen Business School, students were informed that, as part of the study programme, work teams of five students each based on their learning styles profiles would be formed for the first term. In order to participate in the team-formation process, they would receive a learning styles test for completion prior to commencement of the term. In addition, students were informed that the test itself would be part of the curriculum in the course on Psychological Testing.

- In order to maximise their possibility of participation, students received the Danish Self-Assessment Learning Styles Inventory (D-SA-LSI) (Nielsen, 2005a) both by e-mail and at their postal address, together with instructions for completing and returning the test.
- Individual learning styles profiles were generated and student teams were formed.
- The day before the start of the term, students received their personal learning styles profile as well as an interpretation manual by e-mail.
- As part of the first class of the term, students were informed about the resulting teams and given their first team assignment. In the study programme, students are required to complete and present a team assignment within the first two weeks of the term, and they are given team assignments on a regular basis throughout the term. In addition they complete a cross-disciplinary team project in which they are examined individually at the end of the term (psychology and economics).
- The second class of the term was in the subject of Psychological Testing. Here the students were informed of the team-formation criteria and how they had been applied, and they were given a lecture on learning styles and their possible uses.
- The test itself and relevant literature formed part of the curriculum for the course on Psychological Testing.
- In the individual examination assignment in the subject of Psychological Testing, they were given the option of elaborating on the given problem using their own experiences with the learning styles test.

The evaluation consisted of a quantitative evaluation survey of the students' uses of and benefits from the learning styles tools and team formation during the term, and two focus group interviews elaborating the results of the survey:

- The evaluation survey was conducted at the end of the semester after the examination assignment in Psychological Testing had been handed in, but prior to marking.
- The focus group interviews were conducted after preliminary analysis of the results of the evaluation survey, and after the marks for the examination in Psychological Testing had been given to the student.

Participants and instruments

The initial sample consisted of 128 BSc (Business Economics and Psychology) students admitted to Copenhagen Business School (CBS) in 2007. One student declined admission to CBS and was accordingly removed from the sample. Of the remaining 127 students, 124 completed the Danish Self-Assessment Learning Styles Inventory prior to semester start (the initial evaluation sample).

The quantitative evaluation questionnaire was administered to the 124 students in the initial evaluation sample. Of these, 96 students (77%) completed the questionnaire (the evaluation sample). The gender distribution of the *initial* evaluation sample was 80% female and 20% male students, and their average age was 22.2 years with a range from 18 to 39 years.

As part of the evaluation questionnaire, students were asked if they would participate in a focus group interview – 17 students volunteered. Of these, 12 were picked at random and contacted to set up an interview. This resulted in two interview groups, each with five students, since two students eventually did not want to participate.

Two instruments were employed in the present study: the Danish Self-Assessment Learning Styles Inventory (D-SA-LSI) and an evaluation questionnaire.

The D-SA-LSI (Nielsen & Kreiner, 2005; Nielsen et al., 2007) is a Danish adaptation of Sternberg's (1997) Thinking Styles Inventory (TSI) specifically measuring learning styles. The D-SA-LSI is a self-report inventory consisting of 98 statements. There are seven statements for each of the 14 learning styles scales, with 13 of these scales corresponding to the styles set forward by Sternberg (1997) in his theory of mental self-government, and the fourteenth scale corresponding to the Democratic style (Nielsen et al., 2007). The statements were rated according to how well they described participants in learning situations in the context of their university study, using a polytomous answering scale with 1 corresponding to 'not at all' and 7 corresponding to 'extremely well'.

The D-SA-LSI has shown a high degree of reliability and validity. Item analysis by graphical loglinear Rasch models (Kreiner & Christensen, 2002) show all 14 scales to be functioning adequately, with seven scales fitting the Rasch model and seven scales fitting the graphical loglinear Rasch model, with reliabilities for the single scales ranging from 0.55 to 0.91 (Nielsen and Kreiner, 2005). The reliabilities are comparable to the ones reported by Zhang (2002a; 2002b) for a Chinese short version of the TSI, and the reliabilities reported by Sternberg (1994) for an earlier version of the TSI.

The evaluation questionnaire contained a number of statements pertaining to the team-formation process, the students' individual benefits of being tested with the learning styles test and the accompanying materials, and the students' collective benefits of being tested with the learning styles test and the accompanying materials. The statements were constructed on the basis of our experience with the benefits found with teachers and students who have participated in learning styles testing and process-oriented workshops on learning and teaching styles with the first author of this paper (for some results of this, see Nielsen, 2008a). The statements were rated using a dichotomous agree-disagree answering scale, and in each of the three sections of statements, students were also given the opportunity to make qualitative statements of their own choice (see Appendix B for survey statements).

In addition, an interview guide was employed in two focus group interviews. The interview guide consisted of the results of the quantitative evaluation requiring elaboration because of apparent contradictions in results, or results where participants were split evenly into an agreeing group and a disagreeing group.

Analyses

Two modes of analysis were employed in the present study. With regard to the quantitative data resulting from the evaluation questionnaire, simple relative distributions of agreement/disagreement with the single statements were calculated.

The transcribed focus group interviews were analysed with regard to the elaborations and discussions both of the quantitative results intended for elaboration and with regard to particular points or themes brought up by the interviewees without elicitation, in order to ascertain possible explanations for these results as perceived by the students.

RESULTS

Twenty-five student work teams were formed; twenty-four of these on the basis of the *a priori* criteria, with the twenty-fifth forming a "remainder group" with five students who did not complete the test and two who did. However, the reality of working with the organisation of a finite number of *real* learning styles profiles in the actual team formation did not arrive at a perfect solution – the different styles were not evenly distributed across the students. Consequently, a number of minor adjustments had to be employed to the team-formation criteria[iii], more specifically:

- *Criterion 1 (the functional styles):* Due to *over*-representation of the Legislative style in the student group, some teams with more than two students with a strong or very strong score on these styles were formed.
- *Criterion 2 (the level styles):* Due to *under*-representation of the Local style, some teams *without* students who had at least a strong score on these styles were formed.
- *Criterion 3 (the leaning styles):* Due to *under*-representation of the Conservative style, some teams *without* students who had at least a strong score on these styles were formed.
- *Criterion 5 (the scope styles):* Due to *over*-representation of the Anarchic style in the student group, some teams with more than two students with a strong or very strong score on these styles were formed.

Ninety-six students (77%) participated in the quantitative evaluation of the team-formation process. Ten students participated in the focus group interviews (five in each interview).

The team-formation process

For four of the survey statements concerning the actual team-formation process and organisation, the degree of student agreement/disagreement was as we had expected, as the majority of students were either satisfied with the process or had benefitted positively from it. The majority of students expressed that they:

- were satisfied with the information given prior to the administration of the learning styles inventory (77%);
- had no or few difficulties completing the learning styles inventory (81%);
- had gained a good understanding of their personal learning styles profile from the interpretation manual (80%); and
- had gained a deeper understanding of their personal learning styles profile through the teaching (81%).

In addition, the majority of participants expressed that:

- they were *not* confused by the dual purposes of completing the learning styles inventory (89%);
- it made a difference to them that they were placed in teams according to their learning styles rather than by mere chance (73%). The participants in the two focus group interviews all found that the learning styles test was an interesting and useful tool for new students, which should be maintained. They stated that the test added professionalism and meaning to the teamwork and probably prevented conflicts, and that it had proved a useful starting point in the self-reflective and narrative work which is part of the first semester of the Business Economics and Psychology Programme.

For one element of the actual team-formation process, the degree of student agreement was lower than we had expected, in that only 48 percent of the participants agreed that an internet version of the learning styles inventory would have made the process smoother and easier for them. In the focus group interviews, participants also disagreed on this question. The reasons given for preferring an internet version of the test were: (1) that a lot of students travel immediately before starting university, and an internet version would facilitate completion independent of their location; and (2) that a lot of students are moving house prior to university start, and therefore the letters containing the test do not reach them at the appropriate time.

In addition, nineteen students chose to give qualitative statements on the team-formation process. The majority of these statements took the form of positive elaborations on their answers. It is noteworthy, however, that four students put forward critical comments towards the same point of the team-formation process in its entirety, namely that the team-formation process had not been integrated with the subject of Psychology. This was also a topic in one of the two focus groups, in which the participants expressed regret that the learning styles profiles and the resulting teams had not carried over into process-oriented work in the subject of Psychology.

Individual benefits from the learning styles test

For three of the survey statements concerning the students' individual benefits from taking the learning styles test, more than two third of the participants had benefitted with regard to:

- improved understanding of their own learning processes on the basis of knowledge on their own learning styles (65%);
- awareness of their own strong and weak learning styles (77%); and
- improved understanding of fellow students' different ways of thinking on the basis of knowledge on learning styles (97%). This point was emphasised as the most important benefit from taking the learning styles test by all participants in the focus group interviews.

In addition, 76% of the participants reported that they had not focused on working with their weaker learning styles, which we had expected due to the simple common human

tendency to want to improve on something perceived as insufficient or weak. However, these answers were explained in the two focus group interviews, in which the participants explained that they had not focused very much on working consciously with their styles – weak or strong – until doing the examination assignment in the subject of Psychological Testing.

In two areas the majority of participating students reported that they had *not* benefitted. Accordingly:

- there was *no* active use of knowledge of own learning styles in preparation for attending classes (85%), and
- *no* active use of knowledge on own learning styles in classes (76%).

In the last two areas of individual benefits, the participating students were divided equally between having benefitted in the proposed way and not:

- 'Learning-wise the learning styles test has made me feel better equipped for my studies' (57% of students indicated that they had benefitted in this way).
- 'I have also used my knowledge of learning styles outside my studies' (50% of students indicated that they had benefitted in this way).

In addition, thirteen students gave qualitative statements on the individual benefits of taking the learning styles test. These statements were a mixture of elaborations on individual positive experiences and remarks expressing beliefs that the individual benefits would become clearer or be enhanced as they continued their studies. Unsolicited agreement to the latter was expressed in both focus groups.

Collective benefits from the learning styles test

As was the case with regard to the individual benefits, all the benefits proposed in the survey concerning the collective benefits of taking the learning styles test were not endorsed by the participating students. Eigthy-four per cent of the participants, however, reported that their team had met the required prerequisite for collective benefits, that is that team members had shared their learning styles profiles. As expected, due to the students having knowledge on the context-specific nature and developmental aspects of the learning styles concept employed, the majority (89%) of the participants had not felt constrained and obliged to take on particular roles in the team on the basis of their learning styles profile. Two further areas of benefit were experienced by more than two third of the participants:

- development of teamwork competencies using knowledge of learning styles and personal learning styles profile (66%), and
- enhanced understanding of other team members when using learning styles as a tool for reflection (82%).

In both focus groups it was made clear that the above two benefits were actually two expressions of the same thing, namely that the participants all emphasised their enhanced tolerance towards differently thinking fellow students as a consequence of taking the learning styles test and gaining knowledge on learning styles. This tolerance, they all

agreed on, had mainly been expressed as acceptance, because they knew that they had been placed in teams on the basis of differences in learning styles in order to enhance the group dynamics.

The majority of participants reported that they had *not* benefitted in the proposed ways:

- In the majority of teams, the learning style profiles had *not* been used actively in working with team processes (74%). 55% state that their team had, however, used their *knowledge* on learning styles, exclusively in their team processes.
- The majority of teams had *not* devoted time to the team members' learning styles throughout the term (83%).

This apparent lack of active use of the learning styles profiles throughout the term as a tool in the teamwork was explained in both focus groups by a lack of time due to a heavy workload with assignments in other subjects. The focus groups further expressed regret that this had been the case as well as the belief that a more active use of the profiles could have been facilitated if their classes had included subjects such as the test's potential as a tool for conflict resolution, and the test as a tool for the more self-reflective parts of their psychology classes.

To summarise, the key findings suggest that although the team-formation process was only loosely linked to the course of study by the learning styles test and knowledge transfer in the form of lectures, the students did benefit in a number of ways, notably (i) enhanced knowledge and understanding of their own learning styles, (ii) enhanced knowledge and understanding of their fellow students' learning styles and (iii) their team work with fellow students.

DISCUSSION AND PRACTICAL IMPLICATIONS

In the existing literature there has been little cross-fertilisation between the team and the learning literature (Mathieu et al. 2008), and we hope that our study will raise interest in this connection. Where much of the research on work groups and teams has focused on the effectiveness of homogeneous and heterogeneous work groups and teams based on demography, training, composition regarding size and tenure, task design and environmental factors (Champion et al. 1993; Cohen & Bailey 1997; Mathieu et al. 2008), the influence of thinking and learning styles has not been thoroughly researched. We suggest that a better understanding of thinking and learning styles in homogenous as well as heterogeneous work groups or teams can support the work of the groups by clarifying preferences and creating a shared language to address the learning process. Hence, we do not see thinking and learning styles as yet another diversity issue but rather as an additional dimension to already researched issues. An important practical implication of working with thinking and learning styles as an additional dimension in group and team work is a better understanding of the learning potential of the group or team which again can help to create strategies for further development and potentially increase efficiency, effectiveness or quality of group work. The present study, however, tells us that heterogeneous teams on the one hand do cause some tension in the team work in the sense that the work process took

longer and was more challenging due to the inherent differences within the team. On the other hand, students also report that they believe that the (professional) heterogeneous approach prevented conflicts on a more personal level, because they were conscious of the value of the differences in the team, and because they were able to take these differences into consideration. These issues are important components in the development of team-work competencies, since heterogeneity and both the difficulties and benefits following from heterogeneity reflect real-life team work.

The methods and results of the present study give rise to a number of points for discussion, of which we have found room for only a few in this paper. An important consideration for further studies and for teachers or study programmes wishing to undertake student team formation on the basis of learning styles or similar student attributes and to set up *a priori* team-formation criteria for this purpose is that the *a priori* criteria will probably not match the real-life situation with a finite number of student profiles to work with. This makes it impossible to follow the criteria perfectly, and the consequences of this should be considered carefully and maybe even made the subject of study.

What can be concluded from this study is that the proposed coupling of the team-formation process and the theoretical course in Psychological Testing *did* in fact feed into the team-formation process by adding an external purpose and thereby additional meaning to this process, and the students *did* think that being placed in work teams on the basis of learning styles made a difference. Students, however, also expressed regret that the team-formation process had not been integrated with classes in process-oriented ways directly aimed at working with team processes and team training activities as well as the self-reflectional parts of their psychology classes. Such integration would, as the students express it, have given them additional benefits from the process. That this probably would have been the case is supported by the more extensive benefits reported by teachers after process-oriented workshops on learning and teaching styles (Nielsen, 2008a). Therefore the conclusion extends to become a recommendation to other teachers or study programmes who wish to engage in student team formation based on learning styles. As in the present study, team formation on the basis of learning styles profiles should be accompanied by materials and knowledge transfer on learning styles in the form of classes/lectures on the nature of learning styles and perspectives for teamwork. In addition, the team formation should be accompanied by more process-oriented classes and exercises concerned with team processes as well as individual reflection exercises in which students are engaged in a more active use of the learning styles profiles as a tool in their studies. It is our conviction and that of the participating students, that if the team-formation process was integrated more directly into one or more courses by means of process-oriented exercises and classes, where students worked directly with their individual and their team-wise learning styles, student benefits would have been greater in enabling more students to apply their knowledge on learning styles more actively in their preparation for and in classes.

In the context of this study, further research into student team formation on the basis of individual learning styles profiles could take many forms. In our opinion the most obvious ‘next step’ resulting from this study is an evaluation of the suggested extended team-formation process – that is a process more closely integrated with psychology classes with respect to process-oriented work and exercises concerned with teamwork – to make sure

that the students' benefits from the process will increase accordingly. We propose that such a more process-oriented and integrated approach will result in more active uses of knowledge (theoretical as well as personal) on learning styles, both individually and collectively, by the students. This will increase the students' benefits from the whole process of team formation and expand their practical teamwork competencies.

In closing, it should be mentioned that as natural as our choices, criteria, and approach may appear in the context of this particular study, we do want to raise a note of caution in relation to the use of learning styles (or any other individual difference) as a basis for team formation with university students in that such an approach requires very careful consideration. First, it is important to emphasise that the use of learning styles must be based on coherence between aims and means and be appropriately used in a critical and informed way. It is very important that the context is considered carefully along with the particular aims that a teacher or a study programme seeks to achieve with student team formation. Second, it is equally important to emphasise that this study was a first and preliminary study on students' self-perceived benefits of team formation based on learning styles, and both quantitatively and more qualitatively diverse research is required in order to gain well-documented insights into the advantages and disadvantages of using learning styles as a basis for student team formation in particular settings.

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APPENDIX A. THE 14 LEARNING STYLES

The *functions* of learning styles are defined according to the three major functions of government, the Legislative, the Executive, and the Judicial, and can briefly be described as: firstly, a preference for problem definition, goal setting and strategy making (Legislative style); secondly, a preference for finding well-defined ways of doing things and execution of pre-defined activities (Executive style); and thirdly, a preference for evaluating and critiquing ideas, processes and results (Judicial style).

The *forms* of learning styles are defined according to four classical forms of government, the Monarchic, the Hierarchic, the Oligarchic, and the Anarchic forms, and can be described respectively as: a preference for fulfilment of a single, most important goal or need at a time (Monarchic style); a preference for fulfilment of a hierarchy of goals of differing importance in a balanced way and being systematic (Hierarchic style); a preference for fulfilment of multiple competing goals of equal conceived importance with multiple, possibly competing, approaches and being multi-systematic (Oligarchic style); a preference for fulfilment of multiple needs and goals of uncertain importance with a random approach and being a-systematic (Anarchic style); and a preference for fulfilment of own goals as well as the goals/needs of others through dialogue, due to the perception that these are equally important (Democratic style).

The *levels* of learning styles are defined according to two basic levels of government, the Global and the Local, and can be described briefly as a preference for large and abstract issues in the world of ideas (Global style), and a preference for problems requiring detailed work and an orientation toward the pragmatics of a situation (Local style).

The *scope* of learning styles is defined according to two basic foci of interest to governments, the External (foreign affairs), and the Internal (domestic affairs), and can be described as a preference for working with others and seeking problems that either involve working with other people or are about other people (External style), and working alone and applying their intelligence to things or ideas in isolation from other people (Internal style).

The *leaning* aspects of learning styles are defined from what could be termed as two basic leanings of governments, the Conservative and the Liberal – in the classical meaning of the terms – and can be described as a preference for existing rules and procedures and seeking familiar/known problems and situations (Conservative style), and a preference for going beyond existing rules and procedures and seeking new/unknown problems or situations (Liberal style).

See Sternberg (1988; 1997) and Nielsen et al. (2007) for in-depth descriptions of these aspects of self-government.

APPENDIX B. THE STATEMENTS OF THE EVALUATION SURVEY

The team-formation process

Agree		Disagree
1. I was satisfied with the information I received prior to completing the learning styles questionnaire (letter from the director of studies + letter/e-mail from Learning Lab)		
2. Answering the questions would have been easier and smoother had I been able to answer via the internet		
3. I had no or few difficulties in completing the learning styles questionnaire		
4. The interpretation manual gave me a good understanding of my learning styles profile		
5. I gained a deeper understanding of my learning styles profile through the teaching		
6. For me it made no difference that we were placed in teams according to learning styles rather than merely by chance		
7. I think it was confusing that the test is being used for both team formation and as part of the curriculum for Psychological Tests		
8. Further comments, if any, about the process …:		

Individual benefits from the learning styles test, etc.

Agree		Disagree
9. I have become aware of my strong and weak learning styles		
10. My knowledge of my own learning styles helps me to understand my learning processes better		
11. I focus most on working with my weak learning styles		
12. I have actively used my knowledge of my own learning styles in my preparation for attending classes		
13. I have actively used my knowledge of my own leaning styles in classes		
14. My knowledge of learning styles has given me a better understanding of my fellow students' different ways of thinking		
15. I have also used my knowledge of learning styles outside my studies		
16. Learning-wise the learning styles test has made me feel better equipped for my studies		
17. Further comments, if any, about individual benefits …:		

Collective benefits of learning styles test, etc.

Agree		Disagree
18. In my team we informed one another of our learning styles profiles		
19. In my team we used the learning styles profiles actively in our team processes		
20. In my team we used our knowledge of learning styles only (and not the profiles) in our team processes		
21. In my team we devoted time to the team members' learning styles throughout the term/semester		
22. I gained a better understanding of the other team members when I reflected on learning styles		
23. I felt constrained and obliged to take on particular roles in the team on the basis of my learning styles profile		
24. The way in which I have used my knowledge of learning styles and my own profile in connection with teamwork has developed my team competencies		
25. Further comments, if any, about collective benefits …:		

26. Would you be willing to take part in a supplementary focus group interview between January 16th and February 10th 2007

    ❑ Yes ❑ No

    Please provide a telephone number where you can be reached to arrange an interview date

    _____

[i] Zhang as well as Sternberg uses the term "liberal" for this styles. However, the term "progressive", which was used by Sternberg in the first paper on the theory of mental-self-government (Sternberg, 1988), is retained in the D-SA-LSI.

[ii] The individual learning styles profiles, resulting from completion of the D-SA-LSI, consist of a strength score for each of the 14 learning style, so in fact all the 14 styles are *always* represented in each profile, but to a varying degree. The five possible strength scores are: very weak, weak, medium strong, strong, and very strong (Nielsen, 2005a).