

# Medical students' attitudes towards group and self-regulated learning

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## Abstract

**Objectives:** The study is aimed at exploring the association between beginning students' attitudes towards group learning and their awareness of learning strategies, to demographic variables and their exposure to problem-based or mixed curricula.

**Methods:** The descriptive cross-sectional design included students (N = 351) from two medical schools with lecture-based and two with problem-based curricula from Germany and Sweden. Gender, age, personal and parents' practice experience within health care were assessed. A questionnaire was designed for measuring attitudes towards group and individual learning, awareness of learning strategies was assessed with the Metacognitive Awareness Inventory. The *t*-test for independent groups was applied to compare dependent variables between personal factors, and multivariate statistics to compare medical schools.

**Results:** Students' personal work experience correlated with

self-regulation ( $t_{(333)} = -3.307$ ;  $p = 0.001$ ) and group learning experience ( $t_{(341)} = -2.971$ ;  $p = 0.003$ ). Students from the German problem-based curriculum reported most experience with group learning (largest mean difference compared to the German lecture-based curriculum = 1.45 on a Likert scale from 1 to 7; SE = 0.181;  $p < 0.001$ ), and were better at regulating their learning strategies than students from the Swedish lecture-based school (mean difference 0.18; SE = 0.181;  $p = 0.034$ ).

**Conclusions:** Students' clinical experience seemed to benefit self-regulation skills. Problem-based teaching methods and early interprofessional education appear to be favorable learning conditions for the development of professional skills.

**Keywords:** Group learning attitudes, learning strategy awareness, problem-based learning, self-regulation, student attitudes

## Introduction

A central objective of medical education is the development of professional skills,<sup>1,2</sup> in particular the readiness to engage in lifelong learning,<sup>3,4</sup> and to participate in interprofessional education<sup>5-7</sup> which demands an "integration of knowledge, skills and attitudes",<sup>8</sup> and generates the ability to collaborate with other health care professionals.<sup>7</sup> Beneficial teaching methods for these complex skills are small group work and self-regulated learning, case-based approaches, and constructivist learning environments, like problem-based learning (PBL). In these approaches knowledge and skills are acquired in interactive and co-constructive processes<sup>9-14</sup> that demand students' motivation to engage in group learning<sup>15</sup>, and their ability to self-regulate their learning activities.<sup>16</sup> However, beginning veterinary students were found to prefer individualistic learning over group work,

and teacher-directed learning over self-directed studies.<sup>17</sup> Due to a lack of experience, they perceived group work and self-directed learning as complicated and overcharging study conditions, or did not understand the relevance for the medical practice.<sup>17,18</sup> This study aims at assessing whether beginning students' attitude towards group learning and ability to self-regulate their learning strategies are related to personal variables and participation in curricula with different teaching methods.

### Assessing attitudes towards group learning

Additional to their cognitive skills and discussion ability, students' attitude towards participation in social learning contexts is essential for effective small group learning.<sup>19,20</sup> The assessment of preferences concerning group learning

contexts is often regarded as an aspect of the cognitive concept of learning styles,<sup>21</sup> or learning preferences.<sup>17,22</sup> However, also evaluations shape a person's learning preference, e.g. the perception of sociocultural norms and values concerning group work as a desirable study setting.<sup>23</sup> In the choice of their place of study, medical students are known to consider a school's teaching approach.<sup>24,25</sup> These kinds of normative beliefs are included in the attitude concept "theory of planned behaviour" by Ajzen.<sup>26</sup> It explains a person's attitudes with three underlying beliefs: a) the respective behaviour of expected outcome (outcome beliefs), b) the individual's perception of other people's norms (normative beliefs) and c) the power of facilitating and impeding factors (control beliefs). The combined effect of these components results in a person's intention to engage in a particular behavior. This theory has been used earlier for studying professional medical training.<sup>27</sup>

### **Attitudes and demographic variables**

Studies of medical students' attitude towards communication skills learning and towards a patient orientation found that female students were more positive than their male peers.<sup>28, 29</sup> Personal experience within health services correlated with a positive attitude towards communication skills training, while parents' health care profession was negatively related.<sup>30</sup>

### **Assessing awareness of learning strategies**

Interactive settings require self-regulated learning, i.e. a person's ability to "set task-related, reasonable goals, take responsibility for his or her learning, and maintain motivation"<sup>31</sup> that comprises cognitive and motivational aspects. Two central cognitive aspects of self-regulated learning are a person's metacognitive awareness and control of learning strategies. These are defined by Schraw and Dennison as the "ability to reflect, understand and control one's learning",<sup>32</sup> including activities like goal setting, planning, self-monitoring, self-evaluation, and reviewing of the learning content.<sup>32,33</sup> Several studies found that a person's preference for group learning contexts and the ability to self-regulate her learning strategies are positively related.<sup>10,17,22</sup> Possibly, students with good self-regulatory control perceive the complexity of group situations as positively challenging.<sup>22</sup>

### **Attitudes towards group learning and self-regulation in lecture-based and problem-based contexts**

Small group work and self-regulated learning are the main teaching methods of PBL approaches.<sup>9,34</sup> Students participating in PBL curricula appear to employ more self-directed learning strategies than students in mainly lecture-based curricula,<sup>10,35</sup> although this may not apply to first and second year students,<sup>16</sup> and may result in different personal styles in adopting self-directive learning strategies. Participation in PBL curricula also improves their active collaboration in small-group tutorials.<sup>36</sup> Graduates from problem-based

curricula rate themselves higher on interpersonal competencies, e.g. team work skills, and self-directed learning.<sup>37, 38</sup> For the study, two medical schools with PBL curricula were selected, one from Germany and one from Sweden, and two with curricula involving mixed teaching approaches.

### **Secondary school education in Germany and Sweden**

Group learning contexts and self-regulated learning as pedagogical methods are introduced at secondary school level. In these aspects, secondary school education in Germany and Sweden is based on different pedagogical traditions and educational aims. Swedish school education is based on egalitarian values where cooperation and discussion among pupils are appreciated as an important learning resource. The German multi-school system implies early selection with a focus on performance and competition. Although interactive learning settings like group discussions and small group work have become common, individual studying is the major learning source.

### **Research objectives**

Considering the relevance of professional skills as a central aim of medical education, students' attitudes towards group learning and their self-regulatory awareness of their learning activities should be assessed in an early study phase. As other attitudes are known to be related to gender and work experiences, these demographic variables need to be taken into account. Probably, students entering curricula with PBL versus traditional, i.e. mixed, teaching approaches differ in their attitude towards group learning and self-regulation.

The study aims to relate beginning students' attitude towards group learning and their awareness of learning strategies to demographic variables, and to problem-based and mixed curricula located in Germany and Sweden. For this purpose, a questionnaire for the assessment of attitudes towards group learning was designed and piloted.

## **Methods**

### **Participating medical schools**

Four medical schools were selected - two applying mixed teaching methods, and two with PBL curricula - one of each located in Sweden and in Germany. While the PBL programs (Witten/Herdecke and Linköping) were national pioneers in the consequent application of PBL methods, the programs applying mixed teaching methods were selected as representatives of medical faculties with a long teaching tradition, and without an explicit introduction of a problem-based curriculum. However, today, also these traditional schools complement lectures with small group instruction and case-based teaching. It can be assumed that the PBL curricula are more similar than the mixed curricula. All programs stated as their study goals students' readiness to collaborate with other healthcare professionals and to engage in lifelong learning.

- 1) The Medical Faculty at the University of Witten/Herdecke, Germany, applies a problem-based learning approach with case based work in small groups. These are completed by practical training and self-organized learning. From the first to the fifth study year, the proportion of practical training versus theory increases.<sup>39</sup>
- 2) The Faculty of Health Sciences of Linköping, Sweden, uses a variety of problem-based learning and integrated study forms. A specific feature is the common instruction of first term students from different health care programs during the first seven weeks, that aims to foster their readiness to engage in interprofessional collaboration.<sup>40</sup>
- 3) The Sahlgrenska Institute at the Swedish University of Gothenburg, Sweden, applies mixed teaching methods, i.e. lectures, seminars, small group learning, and case discussions during the first study phase.<sup>41</sup>
- 4) During the preclinical section (term 1–4), studies at the Medical Faculty of the Philipps University of Marburg, Germany, comprise lectures, seminars (either 20-30 students or problem-oriented seminars in small groups), and practical training. During the first term, lectures are the main teaching method, completed by practical training seminars. At the third term, lectures are the main teaching method, but seminars and practical training play a larger role.<sup>42</sup>

### Study design and data collection

A descriptive cross-sectional design with the independent factor 'medical school' (Witten/Herdecke, Marburg, Linköping, Gothenburg) was used. Data were collected for three types of variables: personal background variables, attitude measures, and metacognitive awareness ratings. In all schools, the questionnaires were distributed to students at the end of the first and third study terms, except at Linköping University, where only first-term students participated. The surveys were distributed after a compulsory lecture.

The students were informed about the study's general aim and their participation was anonymous and voluntary. At the time of data collection the Swedish Act concerning the ethical review of research involving humans comprised research dealing with sensitive personal data, or physical or psychological interventions.<sup>43</sup> In accordance with Linköping University's research ethics' representative, it was not applied for ethical approval. At all participating universities, permission for the questionnaire distribution was obtained by the faculties' deans.

### Measures and instruments

#### *Personal background variables*

The participants' age (response categories 20-23 years and

24 years and above) and gender were assessed, they were asked whether they had personal working experience in health care prior to their medical studies ('yes'/'no'), and whether their parents were working in health services ('yes'/'no').

#### *Development of the "Attitudes towards individual and group learning scale"*

A pilot version of the questionnaire was generated following instructions by Ajzen<sup>44</sup> describing the construction of a survey based on the 'theory of planned behavior'. The theoretical concepts that Ajzen regards as relevant for the formation of an attitude towards a behavior – here, engagement in individual and group learning – 58 statements were generated. These statements were comprised of favorable and unfavorable beliefs about engaging in individual and collaborative learning, perception of subjective norms and social expectations concerning the learning behavior, control beliefs related to individual and group learning settings, experience with group learning situations, and the intention to learn individually and in groups.

Response options were formulated in seven-point Likert formats or as seven-point semantic potentials. The consequent use of statement formats generated from a theoretical construct was assumed to provide best construct validity of the resulting questionnaire. Eighty behavioral science students answered the pilot version. In order to identify the items that represent the theoretical factors best and to reduce the questionnaire to those items that explain most variance, a principal component analysis was conducted.

A Varimax rotation yielded a meaningful five-factor solution containing 39 items that was chosen for the final version of the questionnaire.<sup>45</sup> With the data from the main study, another principal component analysis was conducted. In Table 1, the descriptive statistics and communalities of each item are reported. Table 2 shows the item loadings on the five extracted components, i.e. the scales described below. As a measure of construct reliability, Cronbach's alpha was computed for each scale.<sup>46</sup>

- Scale 1. 'Attitude towards individual learning' (outcome beliefs, control beliefs, and intention to study individually, 16 items, Cronbach's alpha = 0.883).
- Scale 2. 'Attitude towards group learning' (outcome beliefs, control beliefs, and intention to learn collaboratively, 11 items, Cronbach's alpha = 0.910).
- Scale 3. 'Social expectations towards individual learning' (4 items, Cronbach's alpha = 0.484).
- Scale 4. 'Social expectations towards group learning' (3 items, Cronbach's alpha = 0.750).
- Scale 5. 'Experience with group learning' (3 items, Cronbach's alpha = 0.634).

Table 1. Descriptive statistics and communalities of the principal component analysis of each item of the “Attitudes towards individual and group learning scale” (N = 351, Sweden and Germany)

Item	Mean	SD	Communality	
1	I intend during my studies mainly to learn the study contents by independent study	4.18	1.68	0.503
2	I think that it is not important/very important to learn facts and details by heart	4.47	1.33	0.095
3	I think that it is very difficult/very easy to learn facts and details by heart	4.61	1.37	0.493
4	I think that individual learning is ineffective/effective	5.39	1.36	0.653
5	I think that individual learning is bad/good	5.12	1.44	0.541
6	I think that individual learning is unpleasant/pleasant	5.00	1.49	0.533
7	I think that individual learning is meaningless/meaningful	5.59	1.17	0.633
8	I think that individual learning is stressful/relaxing	4.66	1.56	0.402
9	When I learn by myself, I find it easy to recall facts and details	5.29	1.23	0.406
10	My peers think that individual studying is meaningless/meaningful	4.60	1.21	0.381
11	How well are you able to direct your learning process when you learn in a group?	4.35	1.45	0.344
12	Talking with fellow students helps me understanding relationships	5.78	1.09	0.549
13	I intend mainly to learn together with fellow students during my studies	4.28	1.47	0.627
14	When I learn in a group I get a deep understanding of the study content	4.83	1.37	0.567
15	To me, it is not important/very important to understand relationships	6.51	.87	0.258
16	I think that learning in a group is ineffective/effective	4.89	1.44	0.705
17	I think that learning in a group is bad/good	5.26	1.32	0.747
18	I think that learning in a group is unpleasant/pleasant	5.32	1.38	0.535
19	I think that learning in a group is meaningless/meaningful	5.30	1.31	0.641
20	I think that learning in a group is stressful/relaxing	4.34	1.45	0.351
21	I have no/very much experience with small group work	5.18	1.14	0.485
22	When learning by myself, I can control how effective I am	5.40	1.35	0.467
23	When I learn with a group, I usually feel motivated	4.96	1.32	0.489
24	I think that most of my peer students extremely unwillingly/extremely willingly learn individually	4.52	1.24	0.363
25	My present teacher encourages me to learn in a group	3.87	1.65	0.563
26	I have experience with study groups for examination preparation	5.59	1.17	0.543
27	Learning individually is for me very difficult/very easy	5.26	1.42	0.601
28	I think that I am expected to study individually	4.00	1.96	0.551
29	When I learn by myself, I get a deep understanding of the study content	5.13	1.21	0.536
30	At my faculty, individual learning is regarded as the best study method	3.73	1.48	0.445
31	For me, it is not important/very important to gain a deep understanding of the study content	6.27	1.02	0.266
32	When I learn by myself, I usually feel motivated	4.63	1.49	0.509
33	I think that I am expected to learn with a group	3.67	1.74	0.710
34	How well are you able to direct your learning process when you learn individually?	5.31	1.17	0.536
35	When I learn by myself, I find it easy to recall facts and details	3.69	1.75	0.317
36	At my faculty, group learning is regarded as the best study method	4.10	1.44	0.706
37	I have experience with problem-based learning groups	3.51	1.96	0.465
38	I understand relationships best when I learn individually	4.64	1.29	0.372
39	For me, the optimal relationship between individual and group learning would be only individual/only group	3.46	1.22	0.561

Due to its low internal consistency, the third factor was not included in the statistical analyses. The fourth and fifth factors were included in statistical analyses, but interpreted with caution.

Originally, the questionnaire was written in German by the author. In order to preserve its conceptual equivalence, multiple forward translation procedures into English and Swedish were applied to each statement, and to the questionnaire as a whole, including a professional English translator and Swedish native speakers. Also back-translations from the English version into Swedish were provided by Swedish native speakers and into German by German native speakers. The focus was put on describing students' view on their everyday learning behavior. While

the Swedish and German versions were used in the study, the complete English version is presented in Table 1.

### Metacognitive awareness inventory

Students' awareness of their personal learning strategies and of their self-regulatory control were assessed with the Metacognitive Awareness Inventory (MAI) by Schraw and Dennison.<sup>32</sup> The original version of this self-report instrument with 52 items 'knowledge of cognition' and 'regulation of cognition' has been widely applied and has shown to be a valid and reliable measure of metacognitive awareness related to academic learning tasks. Schraw and Dennison found two factors with Cronbach's alphas varying between 0.84 and 0.94.<sup>32,47-49</sup> However, some studies did not

Table 2. Principal component analysis with Varimax rotation on the “Attitudes towards individual and group learning scale” (N = 351, Sweden and Germany)\*

Item	Attitude towards individual learning	Attitude towards group learning	Experience with group learning	Social expectations towards individual learning	Social expectations towards groups learning
1	0.490	-0.418			
2					
3		0.593			
4	0.748				
5	0.713				
6	0.695				
7	0.754				
8	0.580				
9	0.658				
10				0.476	
11		0.542			
12		0.722			
13	-0.309	0.651			
14		0.723			
15	0.306				
16		0.816			
17		0.851			
18		0.710			
19		0.785			
20		0.579			
21			0.637		
22	0.644				
23		0.655			
24				0.582	
25					0.737
26		0.302	0.665		
27	0.704				
28				0.627	0.383
29	0.667				
30				0.632	
31	0.384				
32	0.600		0.342		
33					0.830
34	0.682				
35		0.463			
36					0.788
37			0.606		
38	0.479	-0.334			
39	-0.431	-0.431	0.328		

\* The factor pattern coefficients of 0.30 and below were omitted.

reproduce the two-factor solution,<sup>50</sup> or items loaded high on both factors.<sup>32,48,50</sup> Convergent validations for the questionnaire were provided by several studies involving undergraduate students; the MAI was related with the Learning Strategies Survey (LSS), and the Motivated Strategies for Learning Questionnaire (MSLQ),<sup>51</sup> and loaded on the same factors as beliefs about memory and reasoning abilities.<sup>52</sup> An indicator for divergent validity was the finding that the MAI was not related to fluid or crystallized intelligence.<sup>52</sup> In the study, a shortened form with 20 items was used (14 and 9 items for each scale, respectively), the same that had been applied by Cantwell and Andrew.<sup>22</sup> Answering options were given on a five-point Likert scale from ‘not true of me’ (1) to ‘very true of me’ (5), no items were scored reversely. The scales’ internal consistencies (Cronbach’s alpha) in this study were for ‘knowledge of cognition’ 0.609 (0.79 in Cantwell and Andrews), and for ‘regulation of cognition’ 0.777 (0.84 in Cantwell and Andrews). The fact that the scales’ reliabilities were lower compared to the full length

version may be caused by the reduced item number, or indicate that they contain heterogeneous latent factors.<sup>60</sup> Example items are: 1. ‘Knowledge of cognition’, i.e. a person’s declarative, procedural, and conditional awareness of her learning strategies: “I understand my intellectual strengths and weaknesses.” (declarative), “I can motivate myself to learn when I need to.” (conditional). 2. ‘Regulation of cognition’, i.e. a person’s ability to control her learning activities, including strategies like planning, information management, monitoring, debugging, and evaluating: “I consciously focus my attention on important information.” (information management), “I ask myself how well I accomplished my goals once I’m finished.” (evaluating).

### Analysis

The following statistical analyses were conducted:

- 1) Descriptive statistics of students’ demographic variables for each medical school were calculated.

- 2) The *t*-test were used to find differences between groups ('gender', 'age', 'personal working experience in health services prior to medical studies', and 'parents working in health services') concerning attitude measures ('attitude towards individual learning', 'attitude towards group learning', 'social expectations towards group learning', and 'experience with group learning'), and metacognitive awareness measures ('knowledge of cognition' and 'regulation of cognition').
- 3) Multivariate statistics (MANOVA) with pairwise comparisons were conducted between the four medical schools for 'attitude measures' and 'metacognitive awareness measures' (with Bonferroni adjustment for multiple comparisons). A *p*-value <0.005 was considered as significant.

## Results

### Participants and response rates

Sample sizes varied, due to different class sizes and accessibility of students. As the survey was distributed after a regular lecture, only attending students could be included. A bias in favor of students who were interested in the study subject may be assumed, as survey completion was voluntary and conducted during leisure time. However, this bias should apply to all samples and not limit their comparability. No data exist about the non-responders' background variables. Response rates were calculated as percent of the total number of students per term. Thus, probably a higher percentage of students attending the lectures participated in the study than the response rates suggest (see Table 3).

### Descriptive statistics of personal background variables

Descriptive statistics of personal background variables are shown in Table 3. While most female students were enrolled in Witten (73%; *n* = 63) and Gothenburg (45%; *n* = 98), Linköping and Marburg had the highest proportion of students between 20 and 23 years (Linköping = 48%; *n* = 25; Marburg = 76%; *n* = 175). Compared to Swedish students (Gothenburg 45%; *n* = 98; Linköping 48%; *n* = 25), German students' parents' were less often occupied in the health sector (Marburg = 31%; *n* = 175; Witten/Herdecke = 37%; *n* = 63).

### Mean comparisons

#### *Personal background variables*

With *t*-tests for independent groups, differences on personal background variables were assessed concerning attitude measures and regulation of learning strategies (Table 4). Students' gender was not related to any dependent variable. Age correlated with 'experience with group learning' ( $t_{(342)} = -2.15$ ; *p* = 0.03). Personal work within health care prior to medical studies correlated with 'experience with group learning' ( $t_{(341)} = -2.97$ ; *p* = 0.00), with 'knowledge of

cognition' ( $t_{(340)} = -2.25$ ; *p* = 0.02), and 'regulation of cognition' ( $t_{(333)} = -3.30$ ; *p* = 0.00). Students whose parents were working within health care scored higher on 'social expectations towards group learning' ( $t_{(337)} = -3.01$ ; *p* = 0.00), and 'knowledge of cognition' ( $t_{(340)} = -2.25$ ; *p* = 0.02).

#### *Medical schools*

The variables that had shown a relation to attitude and metacognition measures, 'age groups', 'personal work experience in health services prior to medical studies' and 'parents working within health services', were inserted as covariates in a general linear model with the factor 'medical school' (MANOVA) with Bonferroni correction for multiple comparisons. The MANOVA showed significant differences for the variables 'attitude towards group learning' ( $F_{(3,304)} = 2.58$ ; *p* = 0.03), 'social expectations towards group learning' ( $F_{(3,304)} = 21.92$ ; *p* = 0.00), 'experience with group learning' ( $F_{(3,304)} = 20.83$ ; *p* = 0.00), and 'regulation of cognition' (*p* = 0.04) (see Table 5).

However, no significant differences were found with pairwise comparisons for the variable 'attitudes towards group learning' between the four participating schools, although there was a mean difference of 0.49 (on a scale from 1 to 7) (standard error [SE] = 0.21) between students from Linköping (Sweden) - who reported the most positive 'attitude towards group learning' - and students from Marburg (Germany).

On the variable 'regulation of cognition', students from Witten/Herdecke scored significantly higher than students from Gothenburg (mean difference 0.18; SE = 0.084; *p* = 0.034). The largest differences of 'experience with group learning' were reported by students from Witten/Herdecke compared to students from Gothenburg (mean difference 0.89; SE = 0.20; *p* = 0.00) and Marburg (mean difference 1.45; SE = 0.18; *p* = 0.00).

Students in Marburg had even significantly less 'experience with group learning' contexts than students from Linköping (mean difference = 0.62; SE = 0.25; *p* = 0.03), and from Gothenburg (mean difference = 0.56; SE = 0.15; *p* = 0.00).

The highest 'social expectations towards group learning' were perceived in Linköping (mean difference towards Witten/Herdecke 1.71; SE = 0.30; *p* = 0.00; towards Gothenburg 1.81; SE = 0.28; *p* = 0.00; towards Marburg 2.24; SE = 0.27; *p* = 0.00).

## Discussion

The study showed that attitude differences were related to personal characteristics and teaching approaches. Experience within health services - both personal and parents' - increased self-regulatory skills which were best at the German problem-based school. Interestingly, Swedish students reported essentially stronger perception of social norms favoring group learning, and students from the

Table 3. Teaching methods and descriptive statistics of participating medical schools and of personal background variables (N = 351, Witten/Herdecke, Marburg, Linköping, Gothenburg)

Medical school	Teaching method	Personal background variable		n	(%)
Witten-Herdecke, Germany (n = 63 response rate: 63%)	Problem-based learning and practical training	Gender	Female	45	73
			Male	17	27
		Age (years)	(<20-23)	39	63
			(24-35+)	23	37
		Personal working experience in health care	No	6	10
			Yes	56	90
		Parents working in health care	No	45	73
			Yes	17	37
Marburg, Germany (n = 175 response rate: 60%)	Mixed methods: mainly lectures, practical training, and seminars	Gender	Female	93	54
			Male	79	46
		Age (years)	(<20-23)	130	76
			(24-35+)	42	24
		Personal working experience in health care	No	61	36
			Yes	110	64
		Parents working in health care	No	118	69
			Yes	54	31
Linköping, Sweden (n = 25 response rate: 50%)	Problem-based learning and practical training	Gender	Female	11	44
			Male	14	56
		Age (years)	(<20-23)	20	80
			(24-35+)	5	20
		Personal working experience in health care	No	13	52
			Yes	12	48
		Parents working in health care	No	13	52
			Yes	12	48
Gothenburg, Sweden (n = 98 response rate: 60%)	Mixed methods: lectures, seminars, small group learning, laboratory instruction, and case discussions	Gender	Female	61	63
			Male	36	37
		Age (years)	(<20-23)	59	61
			(24-35+)	38	39
		Personal working experience in health care	No	48	49
			Yes	49	51
		Parents working in health care	No	53	55
			Yes	43	45

Swedish PBL school tended to hold the most positive attitude towards group learning.

### Personal background

Attitudes towards individual and group learning were not related to any demographic variable. However, personal and parents' health care experience appeared to promote students' ability to learning strategies. Personal work experience was also beneficial for knowledge of cognition, while parental work correlated with perceived social expectations in favor of group learning. Work experience prior to academic studies seemed to be a relevant factor for students' awareness and application of personal learning strategies and their appreciation of group learning contexts. Probably, practical experience helps students to get a clear picture of the future work and enables them to structure the study contents. This consideration will be discussed later under the heading 'knowledge and self-regulation of learning strategies'. As expected, age correlated with group experience.

### Attitude towards individual and group learning

In all schools, students reported almost equal scores concerning their attitude towards individual learning. The value of individual studying, e.g. text reading, as an essential part of medical studies, appeared to be unquestioned by students from all participating curricula. However, attitudes towards collaborative learning varied. Although not statistically significant, the mean differences accounted for about 0.5 points on a 7-point Likert scale between students from the problem-based school at Linköping - who were most positive - and students from the lecture-based curriculum at Marburg who had the lowest scores. As the participating students were enrolled in early study terms, it may be argued that these attitude differences reflect students' interest in group learning at study beginning, rather than the impact of different teaching methods.

However, in Linköping, where the students were most positive towards collaborative learning, their attitude might have been influenced by their participation in interprofessional learning groups during the first study weeks.

Table 4. Mean, standard deviation (SD) and significances of attitude and awareness of learning strategies measures as a function of students' personal background variables (N = 351, Sweden and Germany)

Measure	Personal background variable		Mean	SD	t	p
Attitude towards individual learning	Gender	Female	5.09	0.92	-0.508	0.597
		Male	5.15	0.86		
	Age (years)	(<20-23)	5.15	0.86	1.282	0.201
		(24-35+)	5.02	0.96		
	Personal working experience in health care	No	5.09	0.84	-0.315	0.753
		Yes	5.12	0.93		
Parents working in health care	No	5.09	0.92	-0.470	0.639	
	Yes	5.14	0.85			
Attitude towards group learning	Gender	Female	4.76	0.99	1.105	0.270
		Male	4.64	0.93		
	Age (years)	(<20-23)	4.69	0.96	-0.768	0.443
		(24-35+)	4.78	0.99		
	Personal working experience in health care	No	4.72	0.96	0.096	0.923
		Yes	4.71	0.98		
Parents working in health care	No	4.68	1.01	-0.923	0.357	
	Yes	4.79	0.88			
Social expectations towards group learning	Gender	Female	3.86	1.28	-0.109	0.273
		Male	4.02	1.39		
	Age (years)	(<20-23)	3.99	1.28	1.470	0.143
		(24-35+)	3.76	1.42		
	Personal working experience in health care	No	3.95	1.26	0.382	0.703
		Yes	3.89	1.37		
Parents working in health care	No	3.77	1.36	-3.014	0.003	
	Yes	4.22	1.20			
Experience with group learning	Gender	Female	4.43	1.23	1.357	0.176
		Male	4.25	1.27		
	Age (years)	(<20-23)	4.26	1.25	-2.153	0.032
		(24-35+)	4.58	1.22		
	Personal working experience in health care	No	4.10	1.24	-2.971	0.003
		yes	4.51	1.23		
Parents working in health care	No	4.40	1.24	0.888	0.375	
	Yes	4.28	1.27			
Knowledge of cognition	Gender	Female	3.83	0.43	-0.288	0.773
		Male	3.85	0.42		
	Age (years)	(<20-23)	3.84	0.43	-0.119	0.905
		(24-35+)	3.84	0.43		
	Personal working experience in health care	No	3.77	0.46	-2.258	0.025
		Yes	3.88	0.40		
Parents working in health care	No	3.80	0.43	-2.255	0.025	
	Yes	3.91	0.41			
Regulation of cognition	Gender	Female	3.39	0.51	-0.755	0.451
		Male	3.43	0.45		
	Age (years)	(<20-23)	3.41	0.49	0.359	0.720
		(24-35+)	3.39	0.47		
	Personal working experience in health care	No	3.29	0.49	-3.307	0.001
		Yes	3.47	0.47		
Parents working in health care	No	3.37	0.49	-1.942	0.053	
	Yes	3.48	0.45			

In addition, the important role of group work in Swedish secondary school education may have contributed to Swedish students' higher attitude scores in favor of group learning.

#### Knowledge and self-regulation of learning strategies

The highest self-regulation scores were reported by students enrolled in the German problem-based curriculum at Witten/Herdecke, significantly higher than students from the curricula with mixed teaching approaches at

Gothenburg and Marburg. However, this effect was not found for students from Linköping. A possible moderator variable between medical school and self-regulation skills could be students' earlier work experience. This interpretation is supported by the fact that 90% of the students at Witten reported own or familial practice experience in the health sector. Cooper and Stewart observed an increase in self-regulation – but not knowledge of cognition - assessed with the MAI for teachers of different grade levels as a function of age and teaching experience.<sup>53</sup> They argued that



Table 5. Mean, standard deviation (SD), and pairwise comparison (SE and p-value) for attitude measures and awareness of learning strategies compared between four medical schools (N = 351, Sweden and Germany)

Measure	Medical school	Mean	SD	Pairwise comparisons	SE	p
Attitude towards individual learning	Witten Herdecke, Germany	5.09	0.98	Wit : Mar	0.141	1.000
	Marburg, Germany	5.07	0.88	Wit: Lin	0.221	1.000
	Linköping, Sweden	5.23	0.68	Wit: Got	0.156	1.000
	Gothenburg, Sweden	5.07	0.86	Mar: Lin	0.198	1.000
				Mar: Got	0.123	1.000
			Lin: Got	0.205	1.000	
Attitude towards group learning	Witten Herdecke, Germany	4.86	0.86	Wit : Mar	0.153	0.325
	Marburg, Germany	4.56	0.98	Wit: Lin	0.239	1.000
	Linköping, Sweden	5.05	0.61	Wit: Got	0.169	1.000
	Gothenburg, Sweden	4.83	1.03	Mar: Lin	0.214	0.146
				Mar: Got	0.133	0.367
			Lin: Got	0.222	1.000	
Social expectations towards group learning	Witten Herdecke, Germany	4.04	1.13	Wit : Mar	0.193	0.045
	Marburg, Germany	3.51	1.29	Wit: Lin	0.303	0.000
	Linköping, Sweden	5.75	0.92	Wit: Got	0.214	1.000
	Gothenburg, Sweden	3.94	1.23	Mar: Lin	0.271	0.000
				Mar: Got	0.169	0.139
			Lin: Got	0.281	0.000	
Experience with group learning	Witten Herdecke, Germany	5.33	0.98	Wit : Mar	0.181	0.000
	Marburg, Germany	3.88	1.18	Wit: Lin	0.284	0.088
	Linköping, Sweden	4.50	1.28	Wit: Got	0.201	0.000
	Gothenburg, Sweden	4.44	1.26	Mar: Lin	0.254	0.038
				Mar: Got	0.159	0.002
			Lin: Got	0.263	1.000	
Knowledge of cognition	Witten Herdecke, Germany	3.82	0.44	Wit : Mar	0.065	1.000
	Marburg, Germany	3.38	0.43	Wit: Lin	0.102	1.000
	Linköping, Sweden	3.69	0.44	Wit: Got	0.072	1.000
	Gothenburg, Sweden	3.32	0.55	Mar: Lin	0.091	0.693
				Mar: Got	0.057	1.000
			Lin: Got	0.094	0.307	
Regulation of cognition	Witten Herdecke, Germany	3.58	0.49	Wit : Mar	0.075	0.192
	Marburg, Germany	3.33	0.55	Wit: Lin	0.118	1.000
	Linköping, Sweden	3.43	0.49	Wit: Got	0.084	0.034
	Gothenburg, Sweden	3.40	0.49	Mar: Lin	0.106	1.000
				Mar: Got	0.066	1.000
			Lin: Got	0.110	1.000	

teaching experience fosters the development of a “sense of what works best” in their content area. Thus, students’ practical experience might explain contradictory findings concerning students’ self-directed learning skills and the effect of problem-based learning methods to foster this ability.<sup>10,16</sup> Eventually, practical experience accounts more for the development of self-regulatory control than participation in problem-based curricula.

### Experience with group learning

Age and working experience within health care were associated with more group learning experience. Students from Witten/Herdecke reported most group learning

experience and working experience, while students from Gothenburg had engaged least in group learning. However, this scale was afflicted with low internal consistency.

### Social expectations towards group learning

Students from the Swedish problem-based school at Linköping – a renowned model of a consequent PBL teaching approach - reported the highest social expectation towards group learning among all groups and were most positive towards group learning. Interestingly, this effect was not found at the German problem-based school at Witten/Herdecke. High expectations towards group learning were also perceived by students with parents working in the

health care sector. Possibly, these students possess more awareness of the importance of team work for clinical everyday practice.

### Study limitations

The number of participants per university varied due to different class sizes, which were smaller in problem-based programs compared to mixed programs and smaller in Sweden than in Germany. The use of self-report instruments for assessing students' regulation of learning strategies is afflicted with calibration difficulties; students may not be able to report their use of learning strategies,<sup>54</sup> small changes between the translated versions may affect their responses,<sup>55</sup> social desirability effects may have occurred, or, self-reports and behavior may even be unrelated. The use of the attitude concept limits the comparability with studies that use instruments based on other theoretical concepts such as cognitive styles or preferences. The relation of assessed attitudes and beliefs to the intended behavior is susceptible to many influences, e.g. as information available at the time of attitude assessment may not resemble the situation in which the behavior is demanded. The broad conception of students' general attitudes towards group learning limits the questionnaire's predictive power for particular learning situations.

### Conclusions

Students' personal background, in particular their prior experience with clinical practice appears to inform their academic learning: by influencing their attitudes towards the teaching context and their ability to structure their learning activities, and by motivating them to apply to particular medical programs. Thus, problem-based teaching methods may be a necessary condition for fostering professional skills, while the constant contact with clinical environments provides the sufficient condition.

Curriculum planners and teachers of medical professional skills should consider that students' prior practical experience and their perception of social expectations are relevant factors of their motivation to engage in complex learning contexts. An effective pedagogical tool might be the implementation of interprofessional education at an early study phase, as it was the case in Linköping. For students without a background in clinical work, an early integration of practical work could help them developing a lifelong learning attitude and interest in cooperation with other health care professionals. Future studies should aim at investigating the impact of other contextual and personal variables on students' ability to engage in collaborative and self-regulated learning contexts, e.g. the role of group work during secondary school education. Qualitative studies including interviews, focus groups, and observational studies can generate relevant variables, e.g. the role of perceived peer support or discussion and collaboration quality. In order to understand how practical experience

informs self-regulatory control of learning strategies, longitudinal research designs can be useful.

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### Conflict of Interest

The author declares that she has no conflict of interest.

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