

CHAPTER 3

Impact of institute and person variables on teachers' conceptions of learning and teaching

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Abstract

Background

Teachers' conceptions of learning and teaching are important for faculty development to result in enduring changes in teaching practices. Until now, studies on these conceptions have mostly focused on traditional, lecture-based curricula rather than on small-group student-centred educational formats, which are gaining ground worldwide.

Aim

To explore which factors predict teachers' conceptions in student-centred curricula.

Method

In two Dutch medical schools with 10 and 40 years of student-centred education, teachers were asked to fill out the Conceptions of Learning and Teaching (COLT) Questionnaire to assess their 'teacher-centredness', 'appreciation of active learning' and 'orientation to professional practice'. Next, we quantitatively assessed the relations of teachers' conceptions with their personal and occupational characteristics and institute.

Results

Overall response was 49.4% (N=319/646). Institute was the main predictor for variance in all three scales, and discipline, gender, and teaching experience significantly explained variance in two of the scales. More than 80% of the variance was not explained by these factors.

Conclusion

Longer exposure to a student-centred curriculum was associated with fewer teacher-centred conceptions, greater 'appreciation of active learning' and stronger 'orientation towards professional practice'. In line with studies on lecture-based curricula, discipline, gender, and teaching experience also appeared important for teachers' conceptions in student-centred curricula. More research is necessary to better understand the influence of institute on the three teachers' conceptions scales.

Introduction

Teaching practices are influenced by teachers' conceptions of learning and teaching, even though teachers are generally only partially conscious of those conceptions.¹⁻⁴ Following Pratt's⁵ and Kagan's⁶ definition of conceptions as 'specific meanings attached to phenomena which can act as a filter through which new information passes as it is processed', we use the term conceptions to denote what teachers *think* about learning and teaching. Conceptions are comparable to beliefs, though beliefs are more deeply rooted, and different from teachers' intentions, approaches to teaching, or teaching strategies, i.e. what they *intend to do* or what they *actually do* in teaching practice.

While some authors view conceptions as relatively stable entities⁷, others emphasise that conceptions are dynamic and context-dependent, which would accommodate differences between and changes in teachers' conceptions of learning and teaching.⁸⁻⁹ Teachers' conceptions are also considered to predict the transfer to teaching practice of knowledge and notions imparted by faculty development activities.¹⁰ According to some authors, these faculty development activities can only be expected to achieve lasting changes in teaching practice if attention is paid to teachers' conceptions of learning and teaching.^{2,7,8,11}

Information about teachers' conceptions on learning and teaching might also be interesting for individual teachers and for institutes. For teachers, insight into their partly unconscious conceptions might stimulate recognition and lead to reflection and a possible change in conceptions.¹² Furthermore, an institute-wide overview of teachers' conceptions might provide useful information if the institute is involved in a curriculum change towards student-centred education.

Recently, active learning models, including problem-based learning, have been gaining ground, especially in medical education.¹³ Moving from traditional to student-centred education is generally associated with increased emphasis on teacher-student interactions, and this demands a concomitant change in the role of the teacher.^{14,15} Since teachers' conceptions of learning and teaching appear to be a crucial factor for changing teaching practice, we sought to identify factors influencing these conceptions.

Several studies investigating conventional, lecture-based approaches to higher education have considered conceptions in combination with intentions or approaches to teaching.^{16,17} They demonstrated that teachers' conceptions and teaching approaches were influenced by the teaching context. Prosser and Trigwell found that teaching approach was associated not only with the teacher's perception of having control over what was taught and how, but also with student numbers and with the stage of education of students.¹⁶ Also, studies showed that teachers' conceptions and teaching are impacted by academic leadership and management by heads of departments¹⁸⁻²⁰, by the way a curriculum is managed, by conflicts of agency and structure, and by issues around power relations²¹. Although staff of different institutes might have similar beliefs about teaching, the institutes appeared to differ in how much they constrained staff when putting those beliefs into practice.²²

Other studies found that approaches to teaching differed between disciplines. Faculty teaching 'hard science' (e.g. physics) were more likely to adopt an information transmission-teacher-focused (IT-TF) approach than faculty teaching 'soft sciences'²³, and teachers of 'applied hard' disciplines, including medicine, scored significantly higher on the IT-TF scale than teachers of 'pure soft' or 'applied soft' subjects¹⁷. Neumann et al. suggested that the nature of 'pure hard' disciplines might encourage teachers to adopt a teacher-centred approach, whilst 'soft pure' disciplines might favour a tendency towards constructive and interpretative education.²⁴

Approaches to teaching have also been reported to be affected by gender. Female faculty focused less on subject matter and more on critical thinking and engagement²³ and showed a preference for facilitating student learning, interactive teaching, motivating students, the use of media, and job-related training²². Norton et al. attributed these differences in intentions between male and female teachers to different conceptions.²² Likewise, it is widely assumed that increased teaching experience results in increasingly student and learning oriented conceptions.²⁵ However, Stes et al.²⁶ found no relationship between gender or teaching experience and the conceptual change-student-focused (CC-SF) scale of the Approaches to Teaching Inventory (ATI)^{3,27}.

The ATI was used in several studies to investigate conventional lecture-based approaches to higher education.^{3,17,26,28} In our opinion, however, the ATI and other existing instruments, such as the Teaching Perspectives Inventory (TPI)^{29,30} are less suitable for examining teachers' conceptions of learning and teaching in student-centred contexts. The TPI combines actions, intentions and beliefs instead of distinguishing conceptions, and the ATI focuses more on

teaching approaches and intentions than on teachers' conceptions as such. Moreover, the wording of the ATI items is not suitable for student-centred medical education, because its focus is on lecturing rather than on small-group student-centred educational formats.

We therefore prefer to use the 'Conceptions of Learning and Teaching' questionnaire (COLT). This questionnaire was specifically designed to measure teachers' conceptions of learning and teaching in student-centred education.^{31,32} It contains a 'teacher-centredness' scale, which is comparable to the IT-TF scale of the ATI, as well as two new scales: 'appreciation of active learning' and 'orientation to professional practice'.

In the present study, we used the COLT questionnaire to determine whether previous findings on factors influencing the approaches to teaching in traditional, lecture-based curricula would also influence teachers' conceptions in student-centred curricula. Accordingly, our research question was whether variations in teachers' conceptions of learning and teaching in student-centred education can be explained by teaching context, discipline, gender or teaching experience.

Methods

Participants and Setting

We collected data on the conceptions of learning and teaching from faculty with educational tasks in the first three years of the student-centred undergraduate medical curricula of two Dutch medical schools: VU University Medical Centre (VUmc), Amsterdam and Maastricht University Medical Centre (MUMC), Maastricht. As described by Harden et al. 'in student-centred education students have more responsibility towards their own learning (what and how) and in teacher-centred education learning is more passive, the teacher is the key figure, and there is an emphasis on lectures and laboratory work'.³³ These concepts, however, are not polarized but represent a continuum.

VUmc introduced a student-centred curriculum in 2005, and MUMC has used a student-centred approach since its foundation in 1974.³⁴ In both curricula, groups of eight to twelve students attend two weekly sessions in which they work on authentic problems. Teachers are expected to scaffold student learning rather than transmit knowledge. The

two institutes differ somewhat in how problems are stated and in instructions for self-study. In Maastricht, the problems are open and students generate their own learning objectives to be pursued during self-study in between group sessions, while in Amsterdam, students are given assignments for self-study. In both curricula, group work is supplemented by two to four lectures per week, practicals, and dedicated time for self-study. Basic sciences and clinical content are integrated, and students are offered contacts with real patients early in the curriculum.

The participating teachers were actively involved in the delivery, development, or management of small group education, practicals, lectures or a combination of these.

Procedure

A web-based version (using Netquestionnaires™) of the COLT questionnaire was sent to faculty of the two institutes with educational tasks in the first three years of the undergraduate medical curriculum (N = 646). The construction of the COLT questionnaire, including validation and reliability testing, was described previously.³¹ The COLT contains eighteen items (with five-point Likert scales: 1 = strongly disagree, 5 = strongly agree) in three scales: 'teacher centredness', 'appreciation of active learning' and 'orientation to professional practice'. Table 1 presents some of the items measured in each scale. These scales were the dependent variables in this study.

Simultaneously with the COLT, a second questionnaire was used to collect information on additional independent variables derived from the literature 'Teaching context', Discipline (clinical sciences, basic science, other (psychology, sociology)), Gender, 'Teaching experience' (less than five years, five till ten years, more than ten years), Age (younger than 35, 35-50, above 50 years).^{16,17,19,22,23,25,26} 'Teaching context' was assessed as Institute, percentage of working hours devoted to educational tasks (shortened into 'Hours spent on educational tasks'; less than 25% of total working hours, 25-50%, 50-75%, more than 75%), 'Educational role' (delivery; delivery and development, or research or management), and 'Type of educational task' (lecturing; tutoring small groups; a mix of lecturing and tutoring, and/or practicals or skills training).

Data collection started in November 2009 and ended in April 2010. Non-responders received one e-mail reminder, followed by another reminder by telephone or letter. The responding teachers received a small gift (booklet).

The VUmc Ethical Review Committee advised positively on the feasibility of the study. In the invitational e-mail, we explicitly stated that participation was voluntary and that full anonymity was guaranteed.

Table 1: Examples of items of the COLT (Conceptions of Learning and Teaching) - questionnaire

Each item is rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree); available at <http://colt.vumc.nl>

Factor 1: Teacher Centredness

Students learn best when the learning process is guided by an expert who has an overview of the field of interest.

As a teacher I have to indicate clearly what is important and what is less important for the students to know.

I think that as an expert in my field I am eminently suitable to transmit my knowledge to students and that students should not have to look up that knowledge for themselves.

Factor 2: Appreciation of Active Learning

Students learn a great deal by explaining subject matter to each other.

Small group learning motivates students to study.

I think it is more important for students to be able to analyse and critically appraise subject matter than to memorise facts.

Factor 3: Orientation to Professional Practice

I think it is important that educational assignments are derived as much as possible from the students' future professional practice.

Being introduced to the day-to-day practice of their future profession motivates students to learn.

It is a good learning outcome when students demonstrate that they can apply their knowledge during activities in situations in professional practice.

Analysis

To identify significant differences between the two institutes in the independent variables, we conducted Chi-square tests (including p-values). In three multiple regression analyses we explored the relations of each of the three teachers' conceptions scales (dependent variables) with personal and occupational characteristics and institute (independent variables).³⁵ For each scale, the procedure started with entering into the regression model

the independent variable Institute and a subset of independent variables that were also used in other studies on teacher's conceptions: Gender, Discipline, and 'Teaching experience'. The first column of Table 3 shows how these variables were defined and coded. Then the remaining set of personal characteristics was investigated in a stepwise regression procedure to identify additional contributions to the explanation of the variance in a teachers' conception scales. These independent variables were: 'Educational role', 'Hours spent on educational tasks', 'Type of educational tasks', 'Academic status', and Age (see Table 3, first column). The total explained variance of the final model and the significance of the regression (F-test) were obtained, as well as the significance (T-test) of the contribution of each independent variable. The substantiality of the contribution was expressed by the regular and standardized regression coefficients. The latter was used as an indication of effect size using Cohen's categorization: 0.1, 0.3 and 0.5 correspond to small, moderate and large effect sizes, respectively.³⁶ Analyses were conducted using SPSS version 21 (SPSS Inc., Chicago IL).

Results

Comparison of participants' personal characteristics for the two institutes

The overall response rate was 49.4% (N=319/646; Amsterdam 49.6%, N = 184/371; Maastricht 49.1%, N = 135/275)[#]. Incomplete questionnaire forms (N=13) were excluded from the analysis. The groups of respondents and non-respondents were comparable in relation to Gender and Discipline. The Chi-square tests showed that the respondents of the two universities were also comparable with respect to teacher characteristics (Table 2), except for 'Type of educational task'.

Explaining variance in teachers' conceptions by institute and personal characteristics

Table 3 shows the results of the multiple regression analyses for the three teachers' conceptions scales. For Teacher centredness, the explained variance (R^2) was 19%, with significant moderate contributions by Institute (standardized regression coefficient, $\beta=.29$) and Gender ($\beta=.20$), and small contributions by Discipline (Other than clinical sciences; $\beta=-.14$), Teaching experience ($\beta=-.11$), Educational role ($\beta=-.15$), and 'Type of educational tasks' (Lectures only vs. mix; $\beta=.12$).

[#] Because we revised our analyses, the number of respondents in this Chapter and in Chapter 4 differ from those reported in Chapter 2 (N = 324, response rate of 50.2%)

Table 2: Descriptives

The independent variables are presented, including labels, for the two institutes. The last column shows the results of chi-square tests (with p-values) to detect significant differences between the institutes.

<i>Teacher characteristics</i>	<i>Categories</i>	<i>VUmc, Amsterdam</i>		<i>MUMC, Maastricht</i>		<i>Chi-Sq. test</i>
		<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	
Institute	1= MUMC, Maastricht 2= VUmc, Amsterdam	184	100	135	100	
Gender	1= male	89	48.4	58	43.0	.916 (p=.338)
	2= female	95	51.6	77	57.0	
Age	1: < 35 yrs	27	14.7	32	23.7	4.302 (p=.116)
	2: 35-50 yrs	90	48.9	61	45.2	
	3: > 50 yrs	67	36.4	42	31.1	
Discipline	1= Clinical Sciences	93	50.5	65	48.2	5.270 (p=.072)
	2= Basic Sciences	45	24.5	47	34.8	
	3= Other (Psychology, Sociology)	46	25.0	23	17.0	
Teaching experience	1: < 5 yrs	46	25.0	40	29.6	.857 (p=.652)
	2: 5-10 yrs	50	27.2	35	25.9	
	3: > 10 yrs	88	47.8	60	44.5	
Hours spent on educational tasks (percentage of total number of working hours)	1= 0-25%	145	78.8	95	70.4	9.383 (p=.025)
	2= 25-50%	24	13.0	23	17.0	
	3= 50-75%	11	6.0	5	3.7	
	4= 75-100%	4	2.2	12	8.9	
Educational roles	1= teaching only	57	31.0	54	40.0	2.793 (p=.095)
	2= teaching combined with educational management / development and/or research	127	69.0	81	60.0	
Type of educational tasks	1= lectures only	19	10.3	1	0.7	12.555 (p=.002)
	2= tutoring small groups	31	16.9	29	21.5	
	3= mix: lecturing and tutoring, and/ or practicals or skills training	134	72.8	105	77.8	
Academic status	1= full or associate professor	37	20.1	23	17.0	.481 (p=.488)
	2= other	147	79.9	112	83.0	

Table 3: Results of the multiple regression analyses for each of the three COLT scales: 'Teacher centredness', 'Appreciation of active learning', and 'Orientation to professional practice' (N=319)

	Dependent variables									
	Teacher centredness			Appreciation of active learning			Orientation to professional practice			
Independent variables entered in initial model:	R ² =0.19	F(7,311)=10.7	p=.001	R ² =0.10	F(6,312)=6.0	p=.001	R ² =0.08	F(5,313)=5.6	p=.001	
	b ¹⁾	SE ²⁾	beta ³⁾	b	SE	beta	b	SE	beta	p
Constant	3.28	.074	.001	4.03	.072	.001	4.46	.055		.001
Institute (0: MUMC, Maastricht; 1: VUmc Amsterdam)	.32	.059	.29	-.22	.058	-.21	-.22	.051	-.24	.001
Gender (0: female; 1: male)	.23	.062	.20	-.09	.061	-.09	-.17	.054	-.18	.002
Discipline1 (0: Clinical; 1: Basic)	-.06	.068	-.05	.13	.066	.11	.00	.059	.00	NS
Discipline2 (0: Clinical; 1: Else)	-.19	.075	-.14	.13	.074	.10	-.06	.066	-.06	NS
Teaching experience (-1: <5 year; 0: 5-10yr; 1: >10yr)	-.07	.038	-.11	.09	.035	.14	.03	.031	.05	NS
Additional independent variables (stepwise procedure):										
Educational Role (0: teaching only; 1: teaching combined with management/ development / research)	-.17	.064	-.15							.007
Hours spent on educational tasks (-1.5: <25%; -0.5: 25-50%; 0.5:50-75%; 1.5: >75%)				.08	.036	.12				.032
Type of educational tasks1 (0: mix lectures&small groups; 1: lectures only)	.29	.12	.12							.019
Type of educational tasks2 (0: mix lectures&small groups; 1: small groups only)										
Academic status (1: full or associate professor; 0: else)										
Age (-1: <35 year; 0: 35-50yr; 1: >50yr)										

¹⁾ regression coefficient; ²⁾ Standard Error; ³⁾ standardized regression coefficient; ⁴⁾ statistical significance

These results indicate higher ‘teacher centredness’ in Amsterdam, for male vs. female teachers, and for teachers involved with lectures only. Lower ‘teacher centredness’ was indicated if teachers taught a Discipline other than clinical sciences, had more experience and performed other educational roles besides teaching. No additional significant contributions were found for ‘Hours spent on educational tasks’, Academic status, or Age.

For ‘appreciation of active learning’, the explained variance was 10%, with a significant moderate contribution by Institute ($\beta = -.21$), significant small contributions by Teaching experience (.14) and ‘Hours spent on educational tasks’ (.12), hardly significant small contributions by Discipline ($\beta = .11$ and $.10$) and no significant contribution by Gender. ‘Appreciation of active learning’ was lower in Amsterdam, lower for teachers of a clinical discipline, and higher for more experienced teachers and for teachers spending more hours on educational tasks. Other variables did not make a significant contribution.

For ‘orientation to professional practice’, the explained variance was 8%. Institute ($\beta = -.24$) and Gender ($\beta = -.18$) showed significant contributions, indicating that ‘orientation to professional practice’ was low among teachers in Amsterdam, and also lower for male than for female teachers.

Discussion

In this study, we used the COLT questionnaire to determine whether previous findings on factors influencing the approaches to teaching in traditional, lecture-based curricula would also influence teachers’ conceptions in student-centred curricula. Accordingly, our research question was whether variations in teachers’ conceptions of learning and teaching in student-centred education can be explained by teaching context, discipline, gender or teaching experience.

Institute appeared to be the main predictor of the scores on all three COLT scales, with effect sizes indicating moderate or small to moderate effects. Gender contributed to ‘teacher centredness’ and slightly to ‘orientation to professional practice’, Discipline had a small contribution to ‘teacher centredness’ and even smaller to ‘appreciation of active learning’, and ‘Teaching experience’ contributed to ‘teacher centredness’ and to a small extent to ‘appreciation of active learning’. In table 4 we compared our findings with those

from previous studies. Further, the variables 'Educational Role' en 'Educational task/ Lectures only' contributed to the scale 'teacher centredness', and the variable 'Hours spent on educational tasks' contributed to the scale 'appreciation of active learning'.

Our results partly confirm the findings of earlier studies on teachers' conceptions in higher education. Teaching experience had the least predictive effect, which contradicts the frequently mentioned assumption that increased teaching experience is associated with more student-centred and learning-oriented conceptions and approaches to teaching.²⁵

The effect of institute in our study is not explained by massive staff turnover following the start of student-centred education. However, it is possible that teachers with a preference for student-centred teaching might have been attracted or selected to work in Maastricht, which was newly founded as a student-centred curriculum. Other explanations for the effect of institute might be a difference in leadership style¹⁸ and a difference in teaching culture between the two institutes.

However, the most logical explanation for the effect of institute in our study is the longer exposure to student-centred education in Maastricht compared to Amsterdam (40 versus 10 years). This longer exposure was able to align teachers' conceptions of learning and teaching with the institutional educational philosophy, which would seem to support theories that teachers' conceptions can change. On the other hand, the difference we found between the two institutes suggests that it takes a long time, i.e. more than five years, for teachers to change and become convinced by their lived experiences of the positive effects of student-centred education. This may explain the findings of Kember & Kwan⁷, who concluded that teachers' conceptions are relatively stable entities. This may be particularly applicable when an institute undergoes major curriculum changes, as was the case for Amsterdam, where a traditional teacher-centred and lecture-based curriculum was replaced by a student-centred curriculum in 2005.

Apart from the different traditions of student-centred education in the two institutes we studied, other institutional factors may have contributed to the differences between teachers' conceptions. Differences in curricula, different leadership styles^{18,37}, or different educational climates^{38,39}, characterised by career tracks in education, rewards for good teaching practices, and opportunities for faculty development, may all have played a role.

Table 4: Comparison of the study results with findings from the literature relating to variables to explain approaches to teaching and teachers' conceptions of learning and teaching

Variables	Previous findings	Our study: Predictors of conceptions of learning and teaching in student-centred medical curricula
Teaching context: Institute	<p>A 'conceptual change and student-focused approach' to teaching is associated with the perception that</p> <ul style="list-style-type: none"> [1] teacher has control over what is taught and how, [2] department values teaching, and [3] class size is not too large.¹⁶ <p>Experiences of academic leadership and management by heads of departments were associated with teachers' approaches to teaching¹⁸</p>	<ul style="list-style-type: none"> • Moderate effect: teachers in Amsterdam indicated a higher 'teacher centredness' • Moderate effect: teachers in Amsterdam indicated a lower 'appreciation of active learning' • Small effect: teachers in Amsterdam indicated a lower 'appreciation of active learning'
Teaching context: Teaching practice	<p>Time, resources, management of curriculum, conflicts of agency and structure, and power relations influence teachers' conceptions and teaching approaches²¹</p> <p>Varying numbers of students, change in main teaching method and the study phase of students may have a stronger effect on student-focused than on teacher-focused approaches¹⁷</p>	<p>Small effect of type of educational tasks: teachers only providing lectures indicated a higher 'teacher centredness'</p>
Teaching context: Educational roles	-	<p>Small effect: teachers also involved in management, research and/or development of education indicated a lower 'teacher centredness'</p>
Teaching context: Hours spent on educational tasks Discipline (clinical sciences, basic sciences; other e.g. psychology, sociology)	<p>Teachers are less likely to adopt a 'conceptual change and student-focused approach' to teaching if academic workload is not appropriate.¹⁶</p> <p>'Hard' sciences: more information transmission and teacher-focused beliefs²³;</p> <p>'Applied hard' discipline (e.g. medicine): higher scores on teacher-focused scale of ATI than in pure soft or applied soft disciplines¹⁷</p>	<p>Small effect: teachers spending more hours indicated a higher 'appreciation of active learning'</p>
Gender	<p>Female teachers preferred to facilitate learning, interactive teaching, motivating students, use of media, and job training (intentions and conceptions)²²;</p> <p>No effect²⁶</p>	<ul style="list-style-type: none"> • Small predictive effect: Disciplines as psychology or sociology (vs. basic sciences or clinical sciences) indicated a lower 'teacher centredness' • Hardly significant: Clinical sciences indicated a lower 'appreciation of active learning' • Moderate effect: males indicated a higher 'teacher centredness'; • Moderate effect: males indicated a lower 'orientation to professional practice'
Teaching experience (often related to age and academic status)	<p>More educational experience leads to more student-centred and learning oriented conceptions²⁵;</p> <p>No effect^{22, 26}</p>	<ul style="list-style-type: none"> • Small effect: more teaching experience indicated a lower 'teacher centredness'; • Small effect: more teaching experience indicated a higher 'orientation to professional practice'

Papinczak described several factors influencing job satisfaction and affective organisation commitment of tutors in problem-based learning.¹⁵ She identified four main themes: job-related factors, job involvement characteristics, professional challenges and responsibilities, and mentoring for learning and support. Interestingly, research into the impact of institutes on teachers' beliefs and practices is also gaining ground in primary and secondary education.^{40,41}

We argue that in curricular innovations often too little attention is paid to the pivotal role of teachers and their conceptions of learning and teaching. Although the results underline the importance of exposure to student-centred education, we think that there are other interventions that can change a teacher's conceptions. First, faculty development may be important during curriculum change. Since we agree with Postareff et al.¹¹ that faculty development can only achieve changes in teaching behaviour if attention is paid to teachers' conceptions of learning and teaching, which cannot be changed overnight, we recommend that faculty development programmes be implemented longitudinally, for instance for the duration of one year. Previous studies have demonstrated the effects of longitudinal programmes on teachers' conceptions and approaches to teaching.^{11,20,42} Faculty development activities that can potentially change teachers' conceptions are communities of practice^{43,44} and individual coaching⁴⁴. These approaches stimulate critical reflection on action, which is a prerequisite for stimulating fruitful discussions, which in turn may eventually change teachers' often unconscious conceptions of learning and teaching. Furthermore, contact with peer teachers in communities of practice can be supportive as well as inspiring.^{15,44} It is conceivable that the mere act of filling out the COLT questionnaire can stimulate teachers to reflect on their conceptions of learning and teaching.

Second, in line with Knight and Trowler¹⁹, Norton et al.²², Ramsden et al.¹⁸, Calkins et al.²⁰, and Bailey²¹, we recommend that heads of departments should be made more aware and take account of the impact of their leadership style on teachers' conceptions of learning and teaching and on their teaching practices.

In view of the difficulty of changing academics' conceptions of learning and teaching⁴⁵, a combination of interventions may be the best strategy to achieve enduring changes of teachers' conceptions. After an intensive one-year programme, for example, Calkins et al. found no change in the conceptions of seven out of the sixteen teachers attending the programme (44%).²⁰ Therefore, our third recommendation is to engage teachers in different areas of the curriculum innovation process: development, educational research,

or management of parts of the curriculum. Our results support this by showing that the variable 'Educational role' was predictive of 'teacher centredness'.

In our study, the explained variance was small (ranging from 8% cent for 'orientation to professional practice' to 19% for 'teacher centredness'). This implies that some 81-92% of the variance in teachers' conceptions remains unexplained by the teacher characteristics included in the study. This indicates that the considerable variance between teachers *within* each institute may exceed the systematic differences *between* institutes. It also suggests that teachers' conceptions may be influenced by predictors we did not include in our study, e.g. differences between departments, including the leadership of the heads of departments. It is likely that departmental characteristics are very important, and presumably they vary largely within one institute. This requires further investigation, preferably in a qualitative study. Other possible predictors we did not include are work engagement⁴⁶, self-efficacy^{47,48}, and motivation^{49,50}. The same may be true for perceived autonomy⁴⁹, perceived ownership of the curriculum, and agency²¹, which would be in line with Prosser and Trigwell¹⁶, who underlined the relationship between teachers' perceptions of the teaching environment and their approaches to teaching. Teachers considered it important to have control over what was taught and how, and to know that their department valued teaching.

Strengths and limitations

This study was limited in domain and setting. We studied one domain of higher education, medicine, in two Dutch institutes with student-centred curricula. However, choosing these institutes allowed us to profit from the rare opportunity to study teachers' conceptions in an institute with 40 years of experience in student-centred education.

Another limitation is that we examined the effects of eight variables, chosen on the basis of previous research. Since this resulted in a small explained variance, further research might focus on other potentially relevant variables, such as departmental characteristics, work engagement, self-efficacy, and motivation. Finally, the response rate to the electronic questionnaire was rather low: 49.4% (319 out of 646 teachers). Nevertheless, responders and non-responders were comparable with respect to gender and discipline, both for the whole group and for the two institutes separately.³¹

A strength of our study is that we were able to compare teachers' conceptions in two institutes with very different histories of student-centred education, demonstrating the impact of institute and, presumably, of the duration of exposure to a student-centred curriculum on teachers' conceptions of learning and teaching. Another strength is that we used the COLT questionnaire, specially developed to assess teachers' conceptions in student-centred curricula.

Future research

It would be interesting to study teachers' conceptions of learning and teaching in a larger number of institutes with varying degrees of exposure to student-centred curricula. This could yield information about teachers' conceptions as well as about the aptitude of these conceptions to change. Another direction for future investigations would be to focus on the impact of institutional and departmental characteristics by examining how teachers' perceptions of the educational context affect their conceptions of learning and teaching. Further research could also explore the relationships between teachers' personal characteristics, such as work engagement, self-efficacy, and motivation, and changes in conceptions of learning and teaching. We recommend a mixed methods approach, combining qualitative and quantitative study designs.

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