Students’ and teachers’ attitudes towards PBL-curruculum components in a medical programme – a follow-up study

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**Abstract**

**Objective:** The aim was to explore students’ and teachers’ attitudes towards horizontal and vertical integration and other components of the curriculum, and to compare these results with data from a study at our medical school published in 2002.

**Methods:** A questionnaire with 17 questions regarding different components of our curriculum was sent to students and staff at our medical school. They were asked to rate the importance of different components on a Likert scale from 1-6. We compared the answers between the two groups, and also compared them with the results from 2002.

**Results:** Horizontal and vertical integration were rated as very important components (Teachers (n=283) median 5 and 5, Students (n=596) 6 and 5 respectively). Students valued lectures and clinical rotations more highly than teachers. Teachers considered laboratory training, training in searching scientific literature, scientific projects, basic education in ethics, reading and discussion of fictional literature, interprofessional components and examinations as significantly more important than the students did.

**Conclusions:** Attitudes have remained positive towards horizontal and vertical integration despite major changes in the curriculum. The majority of the components of our curriculum were well appreciated, indicating that our curriculum is robust, but some components warrant inspection and possible revision.

**Keywords:** Medical education; Horizontal integration; Vertical integration; Problem-based learning
Introduction

In order to better prepare students for the needs of future healthcare, many universities have, over the last 30 years, changed from a mainly traditional and lecture-based education to a more problem-based, student-centred approach (Santos, Figueredo and Vieira, 2019; Servant-Miklos, Woods and Dolmans, 2019). Integration in different areas is a core component of many modern curricula, often centred around problem based learning (PBL).

Horizontal integration implies avoiding studies of individual medical subjects one after the other, e.g. medical chemistry, applied physiology and histology, and instead studying all of them based on cases that illustrate them all. Another important structure of the contemporary problem-based pedagogic model is to apply more clinical situations in the early stages of a medical programme, as well as to connect basic sciences to clinical medicine in the later stages of the undergraduate medical education, so-called vertical integration.

Linköping University in Sweden has had a complete medical curriculum since 1986, and was at the beginning the first medical school in Sweden to employ PBL as a pedagogic tool. Since then the programme has undergone a major revision in the early 2000s and another was launched in 2016. However, the programme is still based on student-centred learning and PBL, including both horizontal and vertical integration.

Currently the programme is composed of 11 semester courses, divided into three separate stages. The first two semester courses (Stage 1) focus on normal physiology and anatomy, whereas pathology, applied pathophysiology and pharmacology are studied during the third to fifth semester courses (Stage 2). The sixth semester course is totally dedicated to an individual scientific study. Stage 3 (semester courses 6-11) is, in addition to PBL-based theoretical parts, made up of clinical rotations within the different medical specialties including general practice.

The curriculum is organised in seven different thematic groups in which teachers representing all included areas take part. These groups are responsible for all educational activities within the group's specific areas. With this approach, the specific thematic groups control all learning objectives and all educational activities within the specific areas over the whole curriculum, including examinations. This enables full control over progression in the learning objectives, i.e. there is a so-called "spiral curriculum" (Harden, 1999). Besides this, professional skills such as ethics, early patient contact and communication skills run a parallel track during the entire programme. Yet another component, which was introduced right at the start in 1986, is interprofessional learning. This involves all students from the faculty of medicine and health with recurrent components regarding teamwork and mutual understanding of the different professions of healthcare (Dahlgren, 2009).

In 2002, roughly 15 years after the start of the curriculum, Brynhildsen and colleagues (Brynhildsen et al., 2002; Dahle et al., 2002) published a survey that evaluated the attitudes among students and teachers to various aspects of the problem-based programme. This study was undertaken before the introduction of the thematic approach, but the curriculum was at the time already arranged as a "spiral curriculum". Both students and teachers considered horizontal and vertical integration to be highly important components of the undergraduate medical programme. In order to follow-up on these results, and to gather more knowledge about the current attitudes among students and teachers regarding different aspects of the programme, we designed a follow-up study.

Since the last survey a number of conditions have changed:

- the number of students enrolled each semester has increased from 40 to around 130
- the number of teachers as well as the proportion of the faculty trained in a PBL curriculum have increased but the teacherto-student-ratio has decreased
the organisational approach with thematic groups was introduced in 2004

a change in how to apply for higher education has been implemented on a national level, making it harder for the university to select students attracted by a PBL-based curriculum and there is a possibility that students who are less motivated to study through a PBL-based programme may constitute a larger proportion of the student group today.

The aim of this study was therefore to explore students' and teachers' attitudes towards horizontal and vertical integration, and to compare these results with previously published data from 2002. In addition, we intended to describe attitudes of the above-mentioned groups towards a number of other pedagogic components of the medical curriculum and explore whether attitudes differed between the specific teacher groups as well as between students at an early and late stages in their studies.

Methods

Students and teachers were asked to answer a survey on attitudes to a number of components within the medical curriculum. In order to maximise the student response frequency this survey was presented by one of the authors (RBT) to students attending one lecture in December 2016 from all semester courses, except the sixth which contained the scientific project and no regular educational activity. Students were encouraged to answer all questions they saw relevant to their educational level, as some questions asked for opinions about specific parts occurring later in the curriculum and therefore yet not experienced by the student. All participation was voluntary. The number of students in each lecture hall was not counted before the survey was handed out, but no student declined to fill out the form.

The survey was digitally presented to:

a) practising physicians involved at a certain level with teaching at the medical programme (equal to at least 40 hours education per semester – the same quantitative involvement as that of a tutorial group supervisor) (n= 163),

b) all academic, non-clinical staff with the same involvement in the medical programme (n= 58) and to

c) academic teachers (senior lecturers or professors) who were also employed part-time by the health care provider, the county council of Östergötland, usually as physicians (n= 62).

This selection of groups was carried out in order to enable comparison with the results of the previous study which used similar inclusion criteria. The electronic questionnaire was sent via email. In order to maximise the response rate, two reminder emails were sent.

The Questionnaire

The questionnaire consisted of 18 questions about the importance of specific components of the current medical programme, and was based on the previous questionnaire (Brynhildsen et al., 2002). One additional question was given to the practising physicians. Respondents were asked to rate the importance of 17 core components of the medical curriculum on a Likert scale from 1 to 6, where 1 represented "not important" and 6 represented "very important". The questionnaire is presented in full in Supplementary file 1 and briefly in Figure 1.

Statistics

SPSS (IBM SPSS Statistics for Windows. Version 25.0 2017) was used for the statistics analysis. Median and mean values were calculated for the questions for all respondents, for teachers and students, and for early (semester
courses 1 and 2) and late (semester courses 10 and 11) students. A Mann-Whitney U test was used for analysing differences between teachers and students as well as between early and late students. An ANOVA was used to compare the different teacher groups to one another.

**Ethics**

Ethical approval for this study was applied for but deemed as not necessary by the Regional Ethical Review Board in Linköping. Information about the study was included in the email presenting the web-based questionnaire to the teachers and in writing along with the questionnaire given to the students. This information emphasised that participation was voluntary. None of the participants can be identified, data are presented solely on a group level, and we considered no harm to the participants could be caused through this study.

**Results/Analysis**

Response rates varied substantially between the different groups (Table 1). The group composed of senior academic lecturers had the highest response rate (72%) whereas the group with the lowest rate were physicians employed by the health care provider (33%).

| Group                                      | No of questionnaires | Respondents |
|--------------------------------------------|----------------------|-------------|
| Students (semester 1-2)                    | 258                  | 169 (66%)   |
| Students (semester 3-5)                    | 309                  | 192 (62%)   |
| Students (semester 7-11)                   | 382                  | 235 (62%)   |
| Clinically active tutors (practicing physicians) | 163                  | 53 (33%)    |
| Non-clinically active tutors (academic staff) | 58                   | 32 (55%)    |
| Academic teachers (senior lecturers and professors) | 62                   | 45 (72%)    |

Since students were encouraged only to respond to questions they saw as relevant to their educational level there were significantly fewer answers to certain questions (numbers 5, 13, 14, 15).

The majority of the components were rated as important (≥ 4) by teachers as well as students.

**Teachers vs Students**

Teachers considered training in laboratory work, training in searching scientific literature, scientific projects, basic education in ethics, reading and discussion of fictional literature, interprofessional components and examinations (both theoretical and other forms of examination) as significantly more important than students did. Students, on the other hand, considered classroom lectures, rotation in hospital clinics and rotation in primary care as more important (Figure 1). No difference was found regarding tutorial group work, training in physical examination, training in basic patient communication, vertical or horizontal integration or rotation in interprofessional training wards. Means, medians and p-values are presented in Table 2.
Table 2: Comparison between the student and the teacher groups

| Question                                             | Teachers mean (median) | Students mean (median) | p-value |
|------------------------------------------------------|------------------------|------------------------|---------|
| 1. Tutorial group work                               | 4.71 (5.0)             | 4.89 (5.0)             | 0.731   |
| 2. Training in laboratory work                       | 4.76 (5.0)             | 4.52 (5.0)             | 0.051   |
| 3. Training in physical examination                  | 5.52 (6.0)             | 5.46 (6.0)             | 0.644   |
| 4. Training in searching scientific literature       | 4.71 (5.0)             | 3.46 (4.0)             | 0.000 *** |
| 5. Scientific project                                | 4.66 (5.0)             | 4.35 (5.0)             | 0.003 ** |
| 6. Training in basic patient communication           | 5.04 (5.0)             | 5.04 (5.0)             | 0.521   |
| 7. Basic education in ethics                         | 4.36 (5.0)             | 3.50 (3.0)             | 0.000 *** |
| 8. Reading and discussion of fictional literature    | 3.52 (4.0)             | 2.30 (2.0)             | 0.000 *** |
| 9. Vertical integration                              | 5.06 (5.0)             | 5.35 (6.0)             | 0.052   |
| 10. Classroom lectures                               | 5.04 (5.0)             | 5.52 (6.0)             | 0.000 *** |
| 11. Horizontal integration                           | 4.83 (5.0)             | 5.05 (5.0)             | 0.288   |
| 12. Interprofessional components                    | 3.49 (4.0)             | 3.09 (3.0)             | 0.011 * |
| 13. Rotation in interprofessional training ward     | 4.69 (5.0)             | 4.59 (5.0)             | 0.602   |
| 14. Rotation in hospital clinic                      | 5.27 (6.0)             | 5.55 (6.0)             | 0.006 ** |
| 15. Rotation in Primary Care                        | 5.15 (5.0)             | 5.35 (6.0)             | 0.020 * |
| 16. Theoretical examinations                         | 5.53 (6.0)             | 5.29 (5.0)             | 0.002 ** |
| 17. Miscellaneous examinations                      | 5.21 (6.0)             | 4.28 (5.0)             | 0.000 *** |
| 18. Occupational preparation                        | 4.95 (5.0)             | 5.12 (5.0)             | 0.138   |

Questions found to differ significantly according to Mann-Whitney test (presented) were also significant according to students t-test. *p<0.05; **p<0.01; ***p>0.001

Figure 1: Comparison of means between teachers and students per component.
Components and corresponding numbers: 1. Tutorial group work; 2. Training in laboratory work; 3. Training in physical examination; 4. Training in searching scientific literature; 5. Scientific project; 6. Training in basic patient communication; 7. Basic education in ethics; 8. Reading and discussion of fictional literature; 9. Vertical integration; 10. Classroom lectures; 11. Horizontal integration; 12. Interprofessional components; 13. Rotation in interprofessional ward; 14. Rotation in hospital clinic; 15. Rotation in primary care; 16. Theoretical examinations; 17. Miscellaneous examinations; 18. Occupational preparation

**Students, Early vs Late**

Students from the early part of the programme valued tutorial group work (mean 5.09 vs 4.41, p < 0.001, Mann-Whitney-U) and reading fictional literature (2.72 vs 2.34, p = 0.035, Mann-Whitney-U) more than students from the later part of the programme. Students from the later semesters however, rated laboratory work (mean 4.56 vs 4.14, p=0.046, Mann-Whitney-U) and training in physical examination (5.67 vs 4.97, p < 0.001, Mann-Whitney-U) higher than students from early semesters (Figure 2).

No significant difference was found among any of the teacher groups for any component.

The subject ranked as most important in the teacher group was theoretical examinations, and in the student group it was hospital clinical rotations. Vertical integration and horizontal integration were ranked as number 4 and 8 by students and as number 6 and 10 by the teachers.

**Figure 2:** Comparison of means between students from early semesters (T1 and 2) and late semesters (T10 and 11) in the programme.
Components and corresponding numbers: 1. Tutorial group work; 2. Training in laboratory work; 3. Training in physical examination; 4. Training in searching scientific literature; 6. Training in basic patient communication; 7. Basic education in ethics; 8. Reading and discussion of fictional literature; 9. Vertical integration; 10. Classroom lectures; 11. Horizontal integration; 12. Interprofessional components; 16. Theoretical examinations; 18. Miscellaneous examinations

**Comparison with our previous study** (Brynhildsen et al., 2002)

Students rated the importance of horizontal integration with a median of five points (mean 4.83) compared with six points (mean 5.34) in 2002, whereas teachers rated this component with a median of five points both times (means 5.05 and 5.01 respectively).

Students now rated vertical integration with a score of 6 compared with 5 in 2002, whereas teachers now rated this as 5 compared with 6 in 2002. No statistical analysis could be undertaken since we no longer had access to the raw data from 2002. No means were presented in the study from 2002.

**Discussion**

Our follow-up study shows that both horizontal and vertical integration are still appreciated and considered important components of our PBL-based curriculum, and that no major changes in attitude have occurred during the last 15 years regarding this. Students now rate the importance of horizontal integration with a median of 5 compared with 6 in 2002, whereas teachers once more rated the importance as 5. A previous study that surveyed the opinions on PBL among tutors in PBL-based medical and dental schools in the USA found similar appreciation levels for PBL in general among the staff (Abdelkarim, Schween and Ford, 2018).

Regarding vertical integration, students in this study rated this as more important than teachers, in contrast to the study from 2002 where teachers scored vertical integration significantly higher than students. It should be noted, however, that there were no major differences in the absolute scores between 2002 and the present study. Students’ attitudes towards integrated education have been studied at other universities and have also been shown to be appreciated components (Postma and White, 2017).

The results from the current survey show that students valued lectures and clinical rotations (both hospital-based and primary care-based) more highly than teachers. Teachers on the other hand valued workshops in literature search, performing a scientific study, seminars on ethics, reading and discussing fictional literature, interprofessional...
integration, and examinations more highly. Students seemed to favour more traditional core components of a medical programme whereas teachers at our faculty valued components added into our medical curriculum in 1986, being important for development of professionalism.

Some items (search of scientific literature, basic education in ethics, reading and discussion of fictional literature and miscellaneous examinations) had a numerically more evident difference between the groups (greater difference than 0.8 in rating between teachers and students). However, from this questionnaire it is not possible to determine why a certain component was scored low. A similar recent survey focusing on education in ethics found that medical students viewed medical ethics as an important subject (Al Mahmoud et al., 2017), perhaps suggesting that one should therefore be cautious when interpreting these data to mean that a given component is of less importance for a future physician. Instead, it is wiser to conclude that it warrants closer inspection and possible revision. It is also possible that students feel a need to prioritise traditional medical subjects over activities related to personal and professional empowerment such as the reading of fictional literature, and this is supported by the results from a recent Canadian survey of 1800 healthcare students (Watson, 2016).

A sub-group analysis of our data revealed that the attitude towards vertical and horizontal integration did not differ between students who had recently started the medical programme compared with students who had nearly completed it. This indicates that the combination of clinical and basic science knowledge was appreciated by the students irrespective of whether they are at the beginning or the end of the programme. Students later in the programme valued laboratory training and training in physical examination more than students from the early part of the programme, maybe reflecting that there is more clinical work in the later parts of the programme. In contrast to this, a larger part of the education is based around tutorial group work in the early parts of our programme, which might explain why students from early semesters rated this as more important.

The transition from undergraduate student to junior doctor is known to be stressful (Brennan et al., 2010) and the attitudes of students change during the course, which emphasises the importance of the question of when this transition occurs and how to best facilitate it. This has been studied before with a focus on interaction with patients and other professionals, suggesting that medical students become more cynical and less altruistic, though this is far from established (Roche et al., 2003).

Since the introduction of PBL as a pedagogic philosophy it has become one of the most scrutinised interventions in medical education (Clarke, 2006; Servant-Miklos, Woods and Dolmans, 2019). Although there is heterogeneity to how universities have implemented PBL, PBL-based education is associated with positive effects on various competencies, especially social and cognitive ones. Examples of such effects include coping with uncertainty, communication skills and self-directed learning, but also better retention of knowledge, student satisfaction and lower dropout rates (Nandi et al., 2000; Koh et al., 2008; Wijnen-Meijer et al., 2015; Quintero et al., 2016; Ma and Lu, 2019). On the other hand, student selection, as well as other factors can lead to bias (Koh et al., 2008).

Swedish medical programmes are currently under revision, and there is a proposal to extend the medical curriculum from 11 to 12 semesters, leading directly to the medical licence (Midlert, 2018). This is in contrast to today’s 11 semesters and a two-year internship before the student obtains the medical licence. Therefore, important questions arise about the need to train students to an adequate level of competence, but in a shorter time. Therefore, in order to create a Swedish national standard for these competences all Swedish medical faculties have set up a national task force to harmonise the standards with the demands (Rosengren et al., 2019).

As more students are enrolled in medical universities, we expect an increase in the number students who are not as motivated as needed. This could result in poorer performance in examinations and may result in doctors having
inadequate training. Therefore, it is crucial to strive to perfect our curricula and to empower students to have strong internal motivation in order to prepare them for their professional work.

**Strengths and Limitations**
This study has several limitations. Firstly, the form of the questionnaire was not validated beforehand, and since the responses were recorded using an ordinal scale one could argue that the means and the difference between means say little about the absolute difference in perception regarding a certain component. We did, however, chose the 1-6 ordinal scale to enable comparison with the previous study. There was a significant difference of mean and median between several questions, indicating that respondents took the time and effort to answer each question independently.

Another limitation was that we did not have access to the raw data from 2002, making direct statistical comparisons impossible.

Response rates to surveys have diminished over recent decades, even more so for electronic forms, and response rates between 10-25% are common (Sheehan, 2001; Woerman *et al.*, 2016; Reinisch, Yu and Li, 2016; Watson, 2016). In the present study, the response rate was lowest for the clinically active physicians, whereas the academic teachers, who are responsible for the majority of the teaching activities, showed a fairly high response rate. We therefore consider the responders as fairly representative, and since the number of responses and the response rate were fairly high, we judge the data to be reliable, despite the risk of non-responder bias.

To our knowledge this is the first study assessing attitudes towards the various components of an entire curriculum. The layouts of medical curricula differ between different universities and different societies. This material includes the opinions of nearly all students and a large portion of the staff, and the questionnaire used was almost identical to the one used in 2002. Therefore, we consider it possible to draw conclusions from these data. However, these results and conclusions may primarily be applicable from a local point of view, and more general conclusions should be drawn with caution.

**Conclusion**

Although substantial changes have been made to the medical programme—in student selection criteria, the number of enrolled students, and in the curriculum—no major changes in attitude towards curriculum components could be found when comparing the study published in 2002 with this study. In addition to this, the vast majority of components were rated as important or very important both by teachers and students. We found this to be in line with other similar studies. Further efforts to look into those components that were rated lower are warranted.

**Take Home Messages**

The high ratings by both students and teachers concerning vertical and horizontal integration remained stable as compared with a previous evaluation in 2002.

**Notes On Contributors**

Rasmus Birch Tyrberg is a resident in anesthesiology and intensive care. He has studied pedagogics in parallel
with his residency.

**Mats Hammar** is a professor in obstetrics and gynaecology. He is a former head of the medical faculty and has previously been the director of the undergraduate medical programme at Linköping University. He has published a number of papers in medical education.

**Jan Brynhildsen** is a professor in obstetrics and gynaecology. He has been the director of the undergraduate medical programme at Linköping University. He has previously published papers in medical education.

**Zoltan Szabo** is a professor in anaesthesiology. He has published papers in medical education and has been deeply involved in the undergraduate medical programme at Linköping University. He has been rewarded several educational prices.

**Eva Nylander** is a professor in clinical physiology. She has more than 30 years of experience of leadership in undergraduate as well as post graduate medical education.

**Bo Davidsson** is a PhD and has published a number of papers in medical education. He is presently active in research and quality assurance within the municipality of Linköping.

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Appendices

None.

Declarations

The author has declared that there are no conflicts of interest.

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Ethics Statement

Regional Ethics Committee of Linköping; No 2016/383-31 Ethical approval for this study was applied for but
deemed as not necessary by the Regional Ethical Review Board in Linköping. Information about the study was included in the email presenting the web-based questionnaire to the teachers and in writing along with the questionnaire given to the students. This information emphasised that participation was voluntary. None of the participants can be identified, data are presented solely on a group level, and we considered no harm to the participants could be caused through this study.

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