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What Factors of the Teaching and Learning Environment Support the Learning of Generic Skills? First-Year Students' Perceptions in Medicine, Dentistry and Psychology

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Future health professions need generic skills in their working lives, such as knowledge analysis, collaboration, communication and problem-solving skills. The teaching and learning environment is crucial in the development of generic skills when studying at university. The aim of this research was to examine students' perceptions of learning generic skills during their first study year and how the teaching and learning environment related to their learning perceptions. The data were collected from first-year students (medicine n = 215, dentistry n = 70 and psychology n = 89) who completed a questionnaire at the end of their first study year. Two cohorts of first-year students from 2020 and 2021 were combined. The teaching and learning environments in medicine, dentistry and psychology differed from each other. The results showed that learning of problem-solving, communication and collaboration skills were emphasized more among medical and dental students, whereas analytical skills more among psychology students. There were no statistically significant differences in perceptions of the teaching and learning environment. Perceptions of generic skills and the teaching and learning environment were positively related to each other. In medicine, the strongest predictors of generic skills were peer support and feedback and in dentistry, peer support, interest and relevance. In psychology, the strongest predictors were interest and relevance. The results emphasize the relevance of the teaching and learning environment in learning generic skills.

Keywords: generic skills, teaching and learning environment, university students, health professions education, higher education, first-year experience

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INTRODUCTION

Learning Generic Skills

Learning academic generic skills, such as analyzing skills, problem-solving, and collaboration and communication skills, in addition to domain specific knowledge and skills, is a key goal of higher education (Tuononen, 2019). Generic skills refer to skills that are general and important in any discipline, although the skills that are required and emphasized in different disciplines vary

(Barrie, 2006). These skills are crucial both for students and their learning in higher education as well as their learning and development throughout their careers. Generic skills are referred to by using several terms, such as key skills, transferable skills, working life skills, core skills, academic competencies, meta-competencies and general characteristics (Barrie, 2006; Tuononen, 2019; Girotto et al., 2021).

There is no coherent definition of generic skills (Barrie, 2006; Chan et al., 2017). The present study focuses on most frequently cited core generic skills: analytical skills, problem-solving skills, collaboration skills, and communication skills (Piróg, 2016; Chan et al., 2017; Liu et al., 2017) which all graduates should achieve and that are important for healthcare professionals (Batalden et al., 2002; Breen et al., 2003; Winston et al., 2012; Joseph et al., 2016; Hamilton et al., 2018; Schot et al., 2020).

University students perceive that collaboration skills develop the least during their studies, even though they are important working life skills (García-Aracil and Van der Velden, 2008; Tuononen et al., 2019a), whereas analyzing skills are well learned at university (Murdoch-Eaton et al., 2016; Tuononen et al., 2019a). Generic skills are also needed in learning, and medical students need them for their academic success (Murdoch-Eaton and Whittle, 2012; Winston et al., 2012; Burch et al., 2018). Therefore, it is important to examine how students perceive the learning of generic skills in health professions education.

Previous research has shown that students learn generic skills better when intertwined with disciplinary content and contexts rather than in separate courses (Bath et al., 2004; Star and Hammer, 2008; Murdoch-Eaton and Whittle, 2012; Virtanen and Tynjälä, 2018). Analytical skills refer to the ability to analyze and critically appraise information, present arguments, and examine things from different perspectives (Winston et al., 2012). In health professions education, analytical and problem-solving skills are needed in clinical reasoning and making decisions about patient care (Monteiro and Norman, 2013; Young et al., 2019; Cooper et al., 2021).

Collaboration and communication skills are crucial for all students, but they are key competences for students graduating from healthcare professions (Cuyvers et al., 2015; Reeves et al., 2015, 2016). Collaboration skills, and in particular, interprofessional collaboration skills are pivotal and should be systematically enhanced during the study years (D'Amour et al., 2005; Bridges et al., 2011; Haddara and Lingard, 2013; Reeves et al., 2017). At the heart of the healthcare professionals' work is good communication with patients, their significant others and the interprofessional team. Indeed, communication skills studies have become an established part of medical education worldwide (Berkhof et al., 2011; Deveugele, 2015; Moura et al., 2021). Specific learning methods have been developed to improve students' communication skills, such as simulated patients followed by reflective feedback discussions (Lane and Rollnick, 2007; Bokken et al., 2009; Cleland et al., 2009; Koponen et al., 2012; El Tantawi et al., 2014; So et al., 2019).

Active and collaborative learning strategies such as problem-based learning (Hmelo-Silver, 2004; Dolmans et al., 2005; Dolmans and Schmidt, 2006; Trullàs et al., 2022), team-based learning (Parmelee and Michaelsen, 2010; Parmelee et al., 2012), case-based learning (Krupat et al., 2016; McLean, 2016) and the flipped classroom (Prober and Khan, 2013; McLaughlin et al., 2014; Hew and Lo, 2018) have been developed to involve students in interactive learning processes in which they collaboratively seek solutions to problems arising from the real-world. What all these learning methods have in common is collaborative learning in small groups, the activation of the learners' existing knowledge, and the application of newly acquired information to the solution of relevant problems and cases. Studies show that problem-based learning (PBL) contributes in many ways to the development of generic skills (Joseph et al., 2016), improves students' communication and collaboration skills, problem-solving skills and development into self-directed learners (Trullàs et al., 2022). However, students need to practice collaboration and teamwork skills to become an active participant in PBL tutorials (Aarnio et al., 2010). One important way to motivate students to learn collaboration skills is to show the connection between collaboration skills and their future working life. Problem-solving skills develop in case-based and problem-based learning (Razzaq and Ahsin, 2011; Gade and Chari, 2012; Karantzas et al., 2013). Critical thinking skills, knowledge acquisition skills (e.g., Joseph et al., 2016; Knipprath, 2017) and the ability to relate knowledge to a range of subjects (basic sciences with preclinical and clinical subjects) improve in active teaching and learning environments (Gade and Chari, 2012). In addition, students perceive that they have learned collaboration and communication skills, the ability to apply clinical reasoning skills, and presentation skills in problem-based learning (Schwartz et al., 1997; Khan and Fareed, 2001). Research among psychology students have shown that generic skills have been learned in working life (Golding et al., 2019). However, generic skills have been examined less among psychology students.

The Interaction Between the Teaching and Learning Environment and Learning Generic Skills

The concept of the teaching and learning environment is used to describe the various elements of the academic environment that support students' quality learning (Entwistle et al., 2003). The teaching and learning environment has been examined through: (1) interest in and relevance of study programs, (2) alignment in teaching, (3) support from other students, and (4) feedback from teachers (Parpala et al., 2010). These elements are related to generic skills and to facilitate students' engagement in deep learning (Entwistle et al., 2002; Parpala et al., 2010; Karagiannopoulou and Milienos, 2018; Utriainen et al., 2018).

A range of elements of the teaching and learning environment support generic skills learning (e.g., Tynjälä et al., 2016; Virtanen and Tynjälä, 2018), such as the use of authentic and complex tasks, combining theory and practice, teacher-student and student-student interaction, peer collaboration, and feedback (Kember and Leung, 2005; Murdoch-Eaton and Whittle, 2012; Virtanen and Tynjälä, 2018). Studies of students' experiences of the teaching and learning environment have shown that peer support encourages their learning the most and constructive feedback and alignment in teaching the least

(Asikainen et al., 2014; Herrmann et al., 2017). The interest and relevance of the subject matter affect students' time and effort management (Parpala et al., 2017). In addition, positive experiences of feedback and support from teachers and other students increase their interest (Hidi and Renninger, 2006) and a stimulating teaching and learning environment leads to high quality learning outcomes (Mikkonen et al., 2009).

The term constructive alignment in teaching and learning refers to instruction in which teachers clearly articulate the intended learning outcomes for students and design learning activities and assessment in a way that directs students toward the learning outcomes (Biggs, 2003). Clear goals and standards (Hongbiao and Zheng, 2017; Liu et al., 2017; Ruge and McCormack, 2017), peer support (El Tantawi et al., 2014; Kridiotis and Swart, 2017), and systematic feedback all foster the development of students' generic skills and improve their interprofessional collaboration skills (Chesluk et al., 2015; McGinness et al., 2019). Unfortunately, medical students have expressed that they get too little feedback about their generic skills (Mubuuke et al., 2016).

Aims of the Study

Still today, little is known about the students' perceptions of the various elements of teaching and learning environment and about the way in which they are related to their perceptions of learning generic skills in health professions education. At the university we are studying, our target groups are students in medicine, dentistry and psychology who study on the same campus. Our research provides keys to how these trainings could be further developed in the health care teaching and learning community.

The aim of this study is to explore how students in medicine, dentistry, and psychology perceive generic skills learning during their first year of study and what are the different dimensions of the teaching and learning environment that are related to generic skills learning. Our specific research questions are as follows:

1) What perceptions do students in medicine, dentistry and psychology have about learning generic skills and their teaching-learning environment at the end of their first study year?
2) What are the differences in perceptions of learning generic skills and teaching-learning environment among students in medicine, dentistry and psychology?
3) What is the relationship between the perceptions of the teaching-learning environment and the learning of generic skills among students in medicine, dentistry and psychology?

MATERIALS AND METHODS

Context

In the current research-intensive university, the Faculty of Medicine educates healthcare professionals, such as physicians, dentists, and psychologists. The degree programs prepare them to become licensed health care professionals. Students in medicine and dentistry pursue a licentiate degree of medicine and dentistry. Studying medicine lasts for 6 years and five and a half years for dentistry. The degrees consist of a biomedical preclinical phase (1st and 2nd years of study) and a clinical phase (from 3rd to 6th years of study). Psychology students complete a bachelor's degree (3 years) and a master's degree (2 years) in about 5 years. Graduates of the Master of Psychology degree receive a license to operate as a healthcare professional (psychologists). Students of psychology also have an opportunity to complete a master's degree that does not lead to the profession of a psychologist.

The Faculty of Medicine implements student-centered, mutually supportive learning methods, strives to reconcile theory and practice, and uses practical professional situations as the basis for teaching and learning. The preclinical phase is largely the same for both medical and dental students, and teaching is largely based on problem-based learning (Norman and Schmidt, 1992; Dolmans et al., 2005; Dolmans and Schmidt, 2006). About 200 medical and dental students are divided into groups of ten, with one or two dental students in each group. In addition to PBL tutorials, students have complementary lectures, assignments and laboratory work. When studying psychology, the first academic year includes basic and intermediate level material as well as material related to research methods in psychology. More detailed descriptions of the used teaching and learning methods are presented in **Table 1**. Because of the COVID-19 pandemic, teaching and learning in medicine, dentistry and psychology was to a great extent organized remotely in 2020 and 2021.

Participants

The study involved 374 first-year students of medicine, dentistry and psychology. The students completed the HowULearn questionnaire (Parpala and Lindblom-Ylänne, 2012) at the end of their first year of study. The questionnaire was sent to the students electronically using the Unihow system which is a digital reflection tool and feedback system. Students fill in the questionnaire as a part of their studying, and are provided with individual feedback for their learning and studying. The response rate was 91.4%. Students were asked for informed consent to use their responses for research purposes. Overall, 76.8% of the students agreed, and only their responses were used in this study. The study combined data from two academic years and cohorts: medical students in 2020 (n = 108) and in 2021 (n = 107), dental students in 2020 (n = 35) and in 2021 (n = 35), and psychology students in 2020 (n = 41) and in 2021 (n = 48).

TABLE 1 | Disciplines and used teaching and learning methods.

Discipline	Teaching and learning methods
Medicine	Problem-based learning, lectures, laboratory work, assignments
Dentistry	Problem-based learning, lectures, laboratory work, assignments
Psychology	Activating lectures, small group teaching, group work, case and observation tasks, experimental tasks and tasks which require application of knowledge

Materials

The HowULearn survey (Parpala and Lindblom-Ylänne, 2012) is used by the university we undertook this study at to provide feedback to students about their learning and to provide the university with information on how to support student learning (i.e., searching for evidence, relating ideas, understanding and systematic learning, workload, and paid employment while studying) throughout their studies until graduation. In this study, the HowULearn questionnaire (Parpala and Lindblom-Ylänne, 2012) was used to measure students' perceptions of generic skills and teaching-learning environment. The measures are presented in **Table 2**. The students were asked how they had developed generic skills, such as analyzing skills, problem-solving skills and collaboration and communication skills. The instrument included eight items. The items originated partly from a review of the literature and partly from the investigation of previous inventories [Course Experiences Questionnaire (CEQ); Wilson et al., 1997; Tuononen et al., 2019b]. The items used in the present study have not been used, and thus detailed analysis was conducted (see section "Analysis").

Students' perceptions of their teaching-learning environment were examined using fourteen items. The scale of the teaching-learning environment included four dimensions: perceived interest and relevance, alignment in teaching, peer support and constructive feedback. The scale originated from the Experiences of Teaching and Learning Environment Questionnaire (ETLQ; Entwistle et al., 2003). The instrument has been validated in other research and found to be robust across contexts (Parpala and Lindblom-Ylänne, 2012; Parpala et al., 2013; Karagiannopoulou and Milienos, 2018; Parra-González et al., 2021). The students responded to all items in this study on a 5-point Likert-type scale ranging from 1 = totally disagree to 5 = totally agree. Items and scales measuring generic skills and different elements of the teaching and learning environment are presented in more detail in **Supplementary Appendix A**.

Analysis

Firstly, Exploratory (EFA) and Confirmatory Factor Analysis (CFA) were performed to investigate the factorial structure of the measures of generic skills. EFA was conducted using SPSS (version 28.0) and CFA was conducted using MPlus (version 8.6; Muthén and Muthén, 1998–2012). EFA using principal axis factoring and promax rotation was conducted to explore the structure of the items measuring generic skills because the instrument was new and it had not been tested and validated in this context. Based on the factor analysis, a three-factor solution was the clearest. All loadings were above the desired 0.32 mark (Tabachnick and Fidell, 2014). Communalities varied from moderate to low and one item remained below the desired 0.40 (Costello and Osborne, 2005). This result was further supported by the results of the testing of a three-factor CFA model (CFI = 0.951, SRMR = 0.044, RMSEA = 0.070). The Comparative Fit Index (CFI), the Standardized Root Mean Square Residual (SRMR) and the Root Mean Square Error of Approximation (RMSEA) were used to assess the overall quality of the model. Cronbach's alphas were 0.77 for knowledge analyzing skills, 0.61 for problem-solving skills and 0.81 for collaboration and communication skills.

The four scales which measured perceptions of the teaching and learning environment were examined with the CFA. The Comparative Fit Index (CFI), the Standardized Root Mean Square Residual (SRMR) and the Root Mean Square Error of Approximation (RMSEA) were used to assess the overall quality of the model. The fit model with the scales was good (CFI = 0.961, SRMR = 0.055, RMSEA = 0.062). Cronbach's alphas were 0.79 for interest and relevance, 0.77 for alignment, 0.63 for peer support and 0.70 for constructive feedback.

A one-way ANOVA was used to analyze differences in generic skills and perceptions of the teaching and learning environment among students in medicine, dentistry and psychology. All the generic skills, except collaboration and communication skills and problem-solving skills were normally distributed. In order to ensure the reliability of the findings, we conducted both parametric and non-parametric tests. These tests yielded similar results. All dimensions of the teaching and learning environment were normally distributed. The relationship between generic skills and teaching and learning environment was explored using Pearson's correlations. A linear regression model (stepwise method) was used to analyze which teaching and learning environment factors had the strongest relationship to generic skills. Separate analyses were conducted for each generic skill, using generic skill as a dependent variable and factors of teaching and learning environment as independent factors. SPSS version 28 was used to conduct the analyses.

TABLE 2 | The scales, factors, number of items and an example item for each factor.

Scale	Factor	Number of items	Example item
Generic skills	Knowledge analyzing skills	3	I have learnt to see things from different points of view.
	Problem-solving skills	2	My studies have developed my problem-solving skills in practical situations.
	Collaboration and communication skills	3	My studies have developed my collaboration skills.
Teaching- learning environment	Interest and relevance	3	I can see the relevance of what we are taught.
	Alignment	4	It is clear to me what I am expected to learn in courses.
	Peer support	3	Talking with other students helps me to develop my understanding.
	Feedback	4	The feedback given helps me to improve my ways of learning and studying.

RESULTS

Perceptions of Generic Skills and the Teaching and Learning Environment Among Students in Medicine, Dentistry and Psychology at the End of the First Study Year

Regarding generic skills, the results showed that all the students, the students in medicine, dentistry and psychology, received the highest scores for skills related to analyzing knowledge. Medical and dental students also scored highly on collaboration and communication and problem-solving skills.

In terms of perceptions of the teaching and learning environment, the students in medicine, dentistry and psychology received the highest scores on peer support. Interest and relevance also received high scores, whereas alignment in teaching and feedback were scored the lowest by the students. **Table 3** presents the means and standard deviations of students' perceptions of learning generic skills and perceptions of the teaching and learning environment among students in medicine, dentistry and psychology.

Differences in Perceptions of Learning Generic Skills and the Teaching-Learning Environment Among Students in Medicine, Dentistry and Psychology

The results of ANOVA showed statistically significant differences in students' perceptions of generic skills among students in medicine, dentistry and psychology (**Table 3**). The results showed statistically significant differences in knowledge analyzing skills [$F(2, 371) = 1.143$, $p = 0.030$, $\eta 2 = 0.02$], problem-solving skills [$F(2, 371) = 7.541$, $p = 0.000$, $\eta 2 = 0.07$] and collaboration and communication skills [$F(2, 371) = 8.697$, $p = 0.000$, $\eta 2 = 0.04$]. The effect size in knowledge analyzing skills as well as collaboration and communication skills can be considered small and the effect size in problem-solving skills can be considered medium (Cohen, 1988). The Bonferroni *post hoc* test was used. The pairwise comparisons showed that students in psychology scored higher than students in dentistry on skills related to analyzing knowledge ($p < 0.05$). Both medical and dental students scored higher than psychology students on problem-solving skills ($p < 0.001$), and medical students scored higher than psychology students on collaboration and communication skills ($p < 0.001$). There were no statistically significant differences in students' perceptions of the teaching and learning environment.

The Relationship Between Perceptions of the Teaching and Learning Environment and Learning Generic Skills Among Students in Medicine, Dentistry and Psychology

The analysis of the data showed that students' perceptions of the teaching and learning environment and learning generic skills were mostly statistically significantly positively related to each other (**Table 4**). The relationship between interest and relevance and all generic skills as well as feedback and all generic skills was statistically significantly positively related among students in medicine, dentistry and psychology.

TABLE 3 | Means and standard deviations of generic skills and elements of the teaching and learning and differences among Finnish students in medicine, dentistry and psychology.

	1. Medicine (n = 215) M (SD)	2. Dentistry (n = 70) M (SD)	3. Psychology (n = 89) M (SD)
Perceptions of generic skills			
Knowledge analyzing skills	3.78 (0.54)	3.71 (0.63)	3.94 (0.59)
Problem-solving skills	3.48 (0.67)	3.48 (0.63)	3.01 (0.89)
Collaboration and communication skills	3.76 (0.66)	3.64 (0.82)	3.38 (0.77)
Perceptions of teaching and learning environment			
Interest and relevance	3.98 (0.64)	3.91 (0.66)	3.88 (0.77)
Alignment	3.63 (0.61)	3.62 (0.56)	3.59 (0.67)
Peer support	4.12 (0.64)	4.00 (0.78)	4.16 (0.67)
Feedback	3.27 (0.72)	3.23 (0.62)	3.12 (0.75)

Bonferroni's test. Knowledge analyzing skills 3 > 2 Problem-solving skills 1 > 3**, 2 > 3**. Collaboration and communication skills 1 > 3**. *p < 0.05. **p < 0.001.*

TABLE 4 | Correlations between perceived generic skills and perceptions of the teaching and learning environment among Finnish students in medicine (n = 215), dentistry (n = 70) and psychology (n = 89).

	Knowledge analyzing skills			Problem-solving skills			Collaboration and communication skills		
	Medicine	Dentistry	Psychology	Medicine	Dentistry	Psychology	Medicine	Dentistry	Psychology
Interest and relevance	0.30**	0.54**	0.54**	0.21**	0.52**	0.24*	0.27**	0.49**	0.30**
Alignment	0.29**	0.19	0.35**	0.22**	0.21	0.29**	0.11	0.30*	0.25*
Peer support	0.30**	0.50**	0.30**	0.21**	0.52**	−0.01	0.43**	0.42**	0.24*
Feedback	0.32**	0.43**	0.34**	0.36**	0.36**	0.32**	0.14*	0.31*	0.32**

***Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed).*

TABLE 5 | Summary of the regression analysis.

	Knowledge analyzing skills			Problem-solving skills			Collaboration and communication skills		
	Medicine[a] β	Dentistry[b] β	Psychology[c] β	Medicine[d] β	Dentistry[e] β	Psychology[f] β	Medicine[g] β	Dentistry[h] β	Psychology[i] β
Interest and relevance		0.37**	0.32**		0.31**	0.39**		0.48**	
Alignment	0.14*								
Peer support	0.21**	0.18*		0.15*	0.26*		0.44**	0.20*	0.28*
Feedback	0.24**	0.18*		0.30**			0.11*		0.31**

*$p < 0.05$, **$p < 0.001$.
[a]$R = 0.462$, adjusted $R^2 = 0.206$ [$F(3, 330) = 29.78$, $p < 0.001$].
[b]$R = 0.609$, adjusted $R^2 = 0.353$ [$F(3, 107) = 21.00$, $p < 0.001$].
[c]$R = 0.431$, adjusted $R^2 = 0.179$ [$F(1, 127) = 28.99$, $p < 0.001$].
[d]$R = 0.367$, adjusted $R^2 = 0.129$ [$F(2, 331) = 25.76$, $p < 0.001$].
[e]$R = 0.551$, adjusted $R^2 = 0.291$ [$F(2, 108) = 23.53$, $p < 0.001$].
[f]$R = 0.337$, adjusted $R^2 = 0.107$ [$F(1, 127) = 16.28$, $p < 0.001$].
[g]$R = 0.452$, adjusted $R^2 = 0.200$ [$F(2, 331) = 42.59$, $p < 0.001$].
[h]$R = 0.531$, adjusted $R^2 = 0.269$ [$F(2, 108) = 21.22$, $p < 0.001$].
[i]$R = 0.413$, adjusted $R^2 = 0.158$ [$F(2, 126) = 12.97$, $p < 0.001$].

Peer support was significantly positively related to all generic skills among students in medicine, dentistry and psychology except to problem-solving skills among students in psychology. Alignment was significantly positively related to all generic skills among students in psychology but not among students in medicine and dentistry.

The linear regression analysis showed that students' perceptions of the teaching and learning environment were differently related to perceptions of generic skills depending on the skill among students in medicine, dentistry and psychology. Knowledge analyzing skills were positively related to alignment ($p < 0.05$), peer support ($p < 0.001$) and feedback ($p < 0.001$) in medicine, interest and relevance ($p < 0.001$), peer support ($p < 0.05$) and feedback ($p < 0.05$) in dentistry, and interest and relevance ($p < 0.001$) in psychology. Problem-solving skills were positively related to peer support ($p < 0.05$) and feedback ($p < 0.001$) in medicine, interest and relevance ($p < 0.001$) and peer support ($p < 0.05$) in dentistry, and interest and relevance ($p < 0.001$) in psychology. Collaboration and communication skills were positively related to peer support ($p < 0.001$) and feedback ($p < 0.05$) in medicine, interest and relevance ($p < 0.001$) and peer support ($p < 0.001$) in dentistry and peer support ($p < 0.05$) and feedback ($p < 0.001$) in psychology. In **Table 5**, the relationships between generic skills and perceptions of the various elements of the teaching and learning environments among students in medicine, dentistry and psychology are presented in more detail.

DISCUSSION

This study focused, firstly, on the perceptions that students in medicine, dentistry and psychology had about learning generic skills and their teaching-learning environment at the end of their first study year, and secondly, how their perceptions about generic skills and teaching and learning environment differed, and thirdly, how the perceptions of the teaching and learning environment were related to perceptions of learning generic skills. Our results showed that the students in medicine, dentistry and psychology scored the highest on knowledge analyzing skills, although other skills were also relatively highly evaluated. The results are in line with previous studies that have shown that university students feel that analyzing skills are well learned at the university (Murdoch-Eaton et al., 2016; Tuononen et al., 2019a).

Our research showed that for students in medicine, dentistry and psychology, the most important element perceived in the teaching and learning environment was peer support. A similar observation has been made in previous studies, which show that peer support was reported the highest of the various elements of the teaching and learning environment among university students (Asikainen et al., 2014; Herrmann et al., 2017). Among the respondents of this study, interest and relevance also received high scores. However, students rated alignment in teaching and feedback the least, meaning we obtained similar results as in previous studies (Asikainen et al., 2014; Herrmann et al., 2017).

There were differences in the perceptions of learning generic skills between the students in medicine, dentistry and psychology. Learning problem-solving, communication and collaboration skills were more emphasized among medical and dental students, while learning analyzing skills was more pronounced among psychology students. One explanation for the results may be that the teaching and learning environments in medicine and dentistry differ from the learning environment in psychology, and that different environments support the development of different generic skills. Studies in psychology include more lectures, i.e., traditional instruction during the first study year, whereas studies in medicine and dentistry include problem-based learning. It should be noted that the differences among the students were rather small although they were statistically significant.

There is evidence that problem-based learning promotes the development of generic skills better than traditional teaching among medical students (Joseph et al., 2016). More precisely, research has shown that problem-based learning fostered the learning of collaboration and problem-solving skills (Razzaq and Ahsin, 2011; Karantzas et al., 2013). It seems that the active learning methods, such as problem-based learning in health professions education, enable students to learn generic skills as they include a variety of active and collaborative learning activities. Such integration of generic skills into disciplinary courses has proven to be a better way to learn these skills than separate courses (Bath et al., 2004; Star and Hammer, 2008; Virtanen and Tynjälä, 2018).

In addition to problem-based learning (PBL), other active learning methods, such as team-based learning (TBL), case-based learning (CBL) and Flipped Classroom, have been developed and implemented in education for health professionals in recent decades (Parmelee et al., 2012; Prober and Khan, 2013; McLean, 2016). What all of these learning methods have in common is the use of authentic problems as stimuli for learning, collaboration and communication in small groups to solve the problems given. They provide a well-designed and student-centered approach to learning, take advantage of small-group work in large groups, and thus provide resource efficiency for teaching (Burgess et al., 2020). In addition to these learning methods, health professions education involves communication skills studies to enhance the future professionals' communication with patients (Berkhof et al., 2011). Surprisingly, there has been little research on the active learning methods except for problem-based learning and generic skills learning, so we cannot answer the question of whether team-based learning, case-based learning, flipped classroom, and communication skills studies promote students' generic skills learning, and if so, how. Therefore, we suggest further studies be undertaken on how different active learning methods foster generic skills learning.

A surprising finding in our study was that there were no statistically significant differences in students' perceptions of the different dimensions of the teaching and learning environment. In other words, despite the differences in their learning environments, they perceived different elements in the teaching and learning environment (interest and relevance of the programs, alignment in teaching, support from other students and feedback from teachers) in the same way. As in a previous study (Tynjälä et al., 2016), students in different courses perceived pedagogical elements similarly. In this study, this may be due to the fact that these elements could also be included in traditional lecture courses.

According to our study, the different dimensions of the teaching and learning environment were positively related to students' perceptions of learning generic skills. In medicine, the strongest predictors of generic skills were peer support and feedback, whereas in dentistry, the strongest predictors were peer support and interest and relevance, and in psychology, interest and relevance. These results indicated that interest and relevance, peer support, and feedback were related to perceptions of learning all generic skills, whereas alignment was only related to analyzing skills. Similarly in previous research, peer support was found to be related to generic skills (Myllykoski-Laine et al, 2022).

Limitations

There are some methodological limitations that should be considered when interpreting the results of the present study. First, the results of this study are based entirely on students' self-reports regarding their perceptions of learning generic skills and perceptions of their teaching and learning environment. Although self-reports have been widely used in assessing students' generic skills, through self-reports it is difficult to ascertain the students' actual performance in real-life environments (Braun and Mishra, 2016). The assessment of students' actual level of generic skills would require performance-based assessment (Zlatkin-Troitschanskaia et al., 2015; Hyytinen et al., 2021). However, self-reports enable students to recognize and evaluate their generic skills and thus develop their reflection skills (Kyndt et al., 2014). Second, it was not possible to draw conclusions about the impact of the specific learning method, i.e., problem-based learning or different elements of teaching and learning environment, on the learning of generic skills. This would require the use of different research design and data, for example, observational data. Third, the factor analysis showed acceptable fit for generic skills instruments, although the Cronbach's alpha for the problem-solving skills scale was relatively low. This could be because the scale included only two items. In addition, one factor measured both collaboration and communication skills, which could be problematic if students perceived learning these two skills differently (Tuononen, 2019). Therefore, a coherent and valid instrument for measuring generic skills should be developed. Fourth, the participants of this study represented students in health care professions. Therefore, the findings cannot be directly generalized to students' perceptions in other disciplines. Finally, the study was conducted at one university in one country.

Conclusion

To conclude, this study contributes to the research into generic skills as well as the interaction between the teaching and learning environment and generic skills learning by highlighting the

importance of different elements of the teaching and learning environment in the learning of generic skills. Learning problem-solving, as well as collaboration and communication skills were more emphasized among medical and dental students, whereas analyzing skills were more pronounced among psychology students. Students' perceptions of learning generic skills were related to perceptions of teaching and learning environment. These differences could be explained by the different teaching and learning environments.

Practical Implications and Future Research

It is important that students have an opportunity to study in active and collaborative learning environments and practice diverse skills and that they are provided with an opportunity for peer support. The study showed that students' perceptions of different elements of the teaching and learning environment, were related to perceptions of learning generic skills. Therefore, they should be considered in teaching and developing curricula. The teachers should pay greater attention to the relevance of the subject matter, as it supports the development of generic skills (Parpala et al., 2017). For example, highlighting the clinical relevance of collaboration skills, motivates students to learn these skills (Aarnio et al., 2010). For students, it is crucial to understand the relevance of generic skills to their studying and future working life so that they are motivated to learn them (Chan and Fong, 2018; Tuononen et al., 2019b). It is also essential that students are given feedback on their development during the courses.

The students, who participated in the study, were first-year students. It is important that students' generic skills are developed from the early phases of university studies. Therefore, it is essential to examine students' perceptions of their generic skills and the relationship between students' perceptions of the teaching and learning environment and generic skills already during the first study year. When interpreting the results it is important to take into account that the results could be different among higher grade students. In the future, it would be important to examine students' perceptions in different phases of their studies and to conduct longitudinal studies on how perceptions of learning generic skills change during the study program. In addition, the actual level of generic skills among students in medicine, dentistry and psychology could be examined in more detail through performance-based assessment, through simulations (Boursicot et al., 2021) and authentic patient encounters (Norcini et al., 2003). Furthermore, it would be intriguing to study the relationship among generic skills, teaching and learning environment and academic achievement.

Finally, it is important to consider what different degree programs could learn from each other about students' generic skills learning. In the design and implementation of curricula it could be considered whether generic skills could be learned through interdisciplinary courses that would enhance students' interprofessional communication and collaboration, skills that are essential to them in the working life (Reeves et al., 2015, 2016, 2017).

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

MR and TT contributed to conception, design of the study, organized the database, and performed the statistical analysis. MR, TT, and EP wrote sections of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2022.886052/full#supplementary-material

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