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Nursing students' perceived autonomy-support by teachers affects their intrinsic motivation, study effort, and perceived learning outcomes

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A B S T R A C T

Background: A flipped classroom is a pedagogical approach utilized to improve students' engagement and intrinsic motivation for learning. In recent years, this approach has been widely used to facilitate student activity as part of their learning.
Aims: Using cardiopulmonary resuscitation (CPR) as an educational case, this study investigates the associations between perceived autonomy-support by a teacher and first-year nursing students' intrinsic motivation, study effort, and perceived learning outcomes.
Methods: From 2018 to 2021, cross-sectional data were collected from 391 first-year nursing students at a large Norwegian university. The questionnaire included the Learning Climate Questionnaire (LCQ), Intrinsic Motivation Inventory (IMI), and Learning Outcomes. Seven hypotheses regarding the associations between perceived teachers' autonomy-support and students' intrinsic motivation, study effort, and perceived learning outcomes in CPR were tested by means of structural equation modelling (SEM).
Results: This study indicates that perceived autonomy-support by a teacher affects first-year nursing students' intrinsic motivation, study effort, and perceived learning outcomes. Perceived autonomy-support by a teacher is significantly directly and indirectly (mediated) associated with students' perceived learning outcomes and indirectly associated with study effort.

1. Introduction

Student motivation is critical for their achievement of competence and graduation (Ahn, Chiu, & Patrick, 2021; Zhang, 2022) . The practices of teachers can influence students' autonomy and competence and thereby their motivation (Ahn, Chiu, & Patrick, 2021). Within the education of healthcare professionals, a transition has increasingly been made from traditional classroom teaching to the flipped classroom approach (Aksoy & Pasli Gurdogan, 2022; Al-Mugheed & Bayraktar, 2021; Fan, Tseng, Chao, Chen, & Jane, 2020; Li et al., 2020; Zhu, Lian, & Engström, 2020). In the Norwegian nursing context, which is the focus of this study, the flipped classroom approach, and the use of student-active learning methods such as multiple-choice questions (MCQ), skills training, Team-Based Learning (TBL), and simulation have grown considerably.

Today's healthcare system is complex and constantly evolving. Educational programs must therefore prepare nursing students for the complex challenges they will face in their future profession (Betihavas et al., 2016; Talbert, 2017). In contrast to other university programs, 50 % of nursing education consists of clinical studies. In addition to extensive theoretical studies, nursing students work at different hospital wards and in municipality health care, including nursing homes and home-based nursing care.

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A flipped classroom is an educational approach that aims to increase student engagement and motivation for learning and thereby improve students' learning outcomes (Betihavas et al., 2016; Phillips & O'Flaherty, 2019; Talbert, 2017). The advantage of using this approach includes that it is flexible and gives students the opportunity to be active in their learning. The flipped classroom approach involves both pre-class asynchronous activities and in-class synchronous activities facilitating students to acquire knowledge at their own pace and assume responsibility for their own learning (Phillips & O'Flaherty, 2019; Talbert, 2017). Pre-class activities involve pre-preparation methods such as study guides, video-lectures, and podcasts, which students then come to class equipped with. In-class activities then focus on applying students' acquired knowledge to practice and discussing issues, allowing students to develop higher order thinking skills such as critical thinking, problem solving, and the application of theory to practice (Betihavas et al., 2016; Phillips & O'Flaherty, 2019; Talbert, 2017).

In short, this means that in a flipped classroom, students do not passively listen to an expert such as a teacher but rather actively partake in their learning processes in many ways. This teaching approach expects and facilitates students to theoretically prepare beforehand and actively apply their knowledge through actions and communication in the classroom. Consequently, the flipped classroom addresses students' autonomous functionality by expecting a working responsibility for their own learning; being a passive listener is not an option. Moreover, while acting and communicating as part of the learning activities in the classroom, relationships are created and facilitated. A sense of competence requires students to perceive their own actions as effective and efficient; consequently, perceived competence demands that students perform actions. While actively accomplishing a procedure in collaboration with other nursing students and the teacher, perceived competence is developed and intensified. Hence, the flipped classroom approach supports students' autonomy, relatedness, competence, and self-regulation, all of which are essential to students' motivation and learning (Ryan & Deci, 2017; Ryan & Deci, 2020). Finally, the flipped classroom allows for a dialog with one's teacher and peers while learning nursing actions, indicating the possibility for a closer relatedness with the teacher.

Studies of the flipped classroom approach in nursing education have explored its relationship with learning and motivation (Al-Mugheed & Bayraktar, 2021; Betihavas et al., 2016; Bingen et al., 2020; Hu et al., 2018; Xiu & Thompson, 2020; Zhu et al., 2020), motivation and learning outcomes (Fan et al., 2020; Park & Park, 2018), and motivation and learning strategies (Aksoy & Pasli Gurdogan, 2022). However, knowledge about the impact of perceived autonomy-support by teachers on nursing students' intrinsic motivation, study effort, and learning in a course utilizing a flipped classroom approach is still scarce.

2. Background

The nursing bachelor education at NTNU (Norwegian University of Science and Technology), Trondheim offers tutorials in cardiopulmonary resuscitation (CPR). A learning design involving various student-active learning methods that utilize technological and digital solutions is implemented to facilitate a progression in learning CPR during the three academic years of the nursing program. The learning activities included in this course are multiple choice questionnaire (MCQ) and skills training as a pre-class preparation along with TBL and simulation as in-class activities. The overarching goal in the CPR learning program is to enhance students' motivation and active participation to achieve specific learning outcomes both theoretically and practically. This learning design was chosen with this in mind. The present study examines first-year nursing students who began their study in three consecutive years.

The Self-Determination Theory (SDT) focuses on an individual's motivation-related qualities and motives (Ryan & Deci, 2017). It also posits that an individual's behavior will regulate within a social context (Ryan & Deci, 2020). Motivation is a multidimensional concept, varying in quality based on the individuals' goals for action. In general, the SDT discusses different motivational aspects understood along a continuum of internalization that ranges from external regulation (extrinsic motivation, which reflects low quality motivation) to internal regulation (intrinsic motivation, which reflects high quality motivation (Deci & Ryan, 2008; Niemiec & Ryan, 2009; Utvær & Haugan, 2016).

Intrinsically motivated behaviors are characterized by choice (i.e., self-determination) and a level of enjoyment (e.g., fun, joy), whereas extrinsically motivated behaviors are characterized by control (Ryan & Deci, 2017). Intrinsic motivation has proven to be the most effective in influencing students' engagement, study effort, learning, and wellness. Intrinsic motivation occurs when students perform an activity because of inherent interest and enjoyment (Ryan & Deci, 2017; Ryan & Deci, 2020).

The SDT posits that students have three basic psychological needs: (1) autonomy, (2) perceived competence, and (3) relatedness. Students must feel free to choose such as doing pre-class learning activities at their own pace (autonomy), feel that they master the activities that they are involved in (perceived competence), and feel connected to other people (relatedness). These three needs must be fulfilled to achieve optimal growth and development (Ryan & Deci, 2017; Ryan & Deci, 2020). The ability to choose activities autonomously is motivated by the satisfaction of these needs (Guay et al., 2000). Accordingly, to enhance learning and competence development, teachers should consider how to facilitate these needs among their students. As previously stated, the flipped classroom approach can be applied to achieve the three basic needs of autonomy, perceived competence and relatedness (McLaughlin et al., 2014; Phillips & O'Flaherty, 2019).

Evidence has shown that to support students' autonomy, teachers and learning designs should provide a clear structure (Fedesco et al., 2019; Ryan & Deci, 2017), as a sense of competency occurs when students perceive their own actions to be effective and efficient (ibid.). When students meet their study challenges and experience progression in developing skills or understanding of the course material, they feel competent (Fedesco et al., 2019; Niemiec & Ryan, 2009; Ryan & Deci, 2017). Perceived competence is essential for students to learn and reach their educational goals. Research discloses that intrinsic motivation is associated with higher study effort (Kusurkar et al., 2013) and consequently with better learning.

A recent study among Norwegian nursing students during COVID-19 indicates that teacher support is significant to students' emotional states and perceived learning while studying nursing during a pandemic (Utvær et al., 2022). Teachers who support students

in reaching their educational goals positively affect students' motivation to learn (Ahn, Chiu, & Patrick, 2021; Federici & Skaalvik, 2014; Ryan & Deci, 2017), especially when they encourage the aforementioned three basic psychological needs (Ahn, Chiu, & Patrick, 2021; Ryan & Deci, 2017, 2020). Learning activities that are challenging and simultaneously explain the benefits for learning are autonomy supportive (Niemiec & Ryan, 2009).

There is some evidence of the relationship between the flipped classroom approach, motivation, and learning among students at different educational levels. A meta-analysis of 95 studies based on data from primary school, junior and high school, and higher education in North America and Asia (Zheng et al., 2020) evaluated the effectiveness of the flipped classroom approach on students' learning achievement and learning motivation. This meta-analysis found that the flipped classroom approach had a positive influence on students' learning achievement and learning motivation (Zheng et al., 2020). A systematic review of five U.S. studies that examined the flipped classroom approach in nursing programs reported mixed results regarding satisfaction; two studies found high satisfaction, while one study found minor student satisfaction (Betihavas et al., 2016). In comparison, a review of randomized controlled trials in nursing education in China found that the flipped classroom approach had overall better results on student knowledge compared to traditional teaching methods (Hu et al., 2018). Moreover, a study of 200 nursing, dental, and medical students in an ophthalmology course showed positive results regarding the students' skills exam scores and self-rated learning abilities (Zhu et al., 2020). The students reported improved learning and improved abilities such as team cooperation, communication, and self-regulated learning. However, some students stated that the preparations required too much study effort (Zhu et al., 2020).

A mixed study using qualitative methods and quantitative surveys that examined 91second-year undergraduate nursing students in South Korea assessed students' learning of the respiratory system by using flipped classroom methods (Choi et al., 2021). The results indicated that utilizing the flipped classroom approach, including pre-class activities (e.g., online lecture videos and reading materials) and in-class activities (e.g., TBL and simulation), helped the students develop their skills beyond mere content acquisition. That is, they also developed skills such as collaboration and the ability to apply theory to real-life clinical scenarios (Choi et al., 2021). However, they also reported workload burden, time burden, lack of familiarity, and lack of motivation while performing pre-class activities. Discussions as part of in-class activities such as TBL as well as quizzes and drawing pictures of assessments were reported as positive experiences (Choi et al., 2021). Bouwmeester et al. (2019) found that medical students attending a hematology and oncology course that utilized a flipped classroom approach initially reported higher levels of self-efficacy. However, the levels of self-efficacy eventually decreased to levels like those of students in a traditional class (Bouwmeester et al., 2019). The study also indicated that the students in the flipped classroom reported a higher workload during the course (Bouwmeester et al., 2019).

A study of 350 South Korean university students attending 12 different courses that utilized a flipped classroom approach assessed the students' experience with the learning design and how it affected their affective and motivational outcomes. The study found that teacher facilitation contributed to students' enjoyment in class, whereas peer interaction affected the students' self-efficacy (Cho et al., 2021). A quasi-experimental study of 485 nursing students in Taiwan showed that the flipped classroom approach had a positive effect on students' learning motivation and learning outcomes (Fan et al., 2020). The nursing students were satisfied with the flipped classroom approach and demonstrated increased levels in core competencies, metacognitive abilities, and self-directed learning. Another quasi-experimental study, which compared learning outcomes before and after a course, indicated better learning outcomes from attending a flipped classroom compared to attending a traditional classroom. Using a t-test and regression analysis, the researchers found that the academic achievement and critical thinking skills of the students in the flipped classroom had increased significantly (Park & Park, 2018).

The present study is based on a learning design that utilizes a flipped classroom approach involving both pre-class and in-class activities to enhance nursing students' intrinsic motivation, study effort, and learning outcomes related to learning CPR. Pre-class activities consisted of self-directed reading materials and MCQ, while in-class activities comprised skills training and TBL.

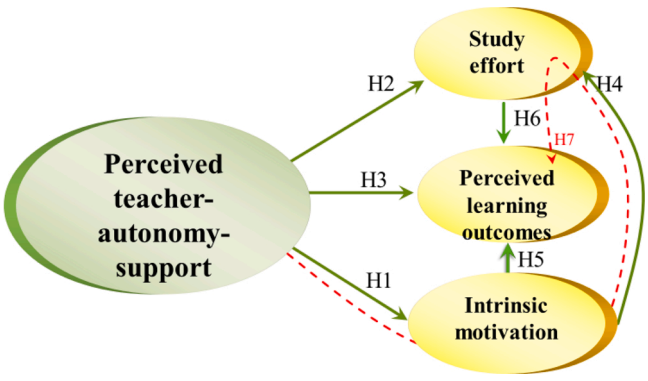

Fig. 1. The seven tested hypotheses in this study. The green arrows represent the direct associations, while the red dotted arrows show the indirect (mediated) associations.

2.1. Aims and hypotheses

The aim of this study is to investigate the associations between perceived autonomy-support by teachers and students' intrinsic motivation, study effort, and perceived learning outcomes. Using CPR as an educational case, the research question addresses whether perceived autonomy-support by teachers affects first-year nursing students' intrinsic motivation, study effort, and learning outcomes.

The following seven hypotheses portrayed in Fig. 1 were tested by means of structural equation modeling (SEM):

Hypothesis 1. *(H1): Students' perceived teacher-autonomy-support directly affects students' intrinsic motivation.*

Hypothesis 2. *(H2): Students' perceived teacher-autonomy-support directly affects students' study effort.*

Hypothesis 3. *(H3): Students' perceived teacher-autonomy-support directly affects students' perceived learning outcomes.*

Hypothesis 4. *(H4): Students' intrinsic motivation directly affects students' study effort.*

Hypothesis 5. *(H5): Students' intrinsic motivation directly affects students' perceived learning outcomes.*

Hypothesis 6. *(H6): Students' study effort directly affects students' perceived learning outcomes.*

Hypothesis 7. *(H7): Students' perceived teacher-autonomy-support indirectly affects students' perceived learning outcomes through students' intrinsic motivation and study effort.*

3. Methods

3.1. Design, participants, and procedure

This study is part of a wider cross-sectional Norwegian study on nursing education that focuses on nursing students' intrinsic motivation and active learning pedagogical methods. A pilot study was conducted in autumn of 2017, followed by the main study in 2019–2021. Quantitative data were collected from first-year nursing students attending one of three campuses at a large Norwegian university in 2019, 2020, and 2021. The inclusion criteria were first-year nursing students at the actual university campus and those who agreed to participate in the study. There were no exclusion criteria. The students received information about the study by e-mail as well as announcements through their learning platform and in class. A reminder to participate was given three times online. Each participant provided voluntarily informed consent.

3.2. Measures

The Learning Climate Questionnaire (LCQ) can be used in various learning settings (Black & Deci, 2000; Williams et al., 1997). It consists of 15 items, with a short version including six items (LCQ 1, 2, 4, 7, 10 and 14). In this study, these six items assessed students' perceived autonomy-support by their teacher. In total, four to six teachers were involved in the specific CPR course; this study assessed the students' experiences with their teachers during class. Examples of sample items were as follows: "I feel that my teachers provide me with choices and options" and "My teachers encouraged me to ask questions." The items were scaled from 1 to 7 ranging from absolutely disagree to absolutely agree with a midpoint of neither.

Intrinsic motivation was assessed by four items belonging to the "interest and enjoyment" subscale from the Intrinsic Motivation Inventory (IMI) (Plant & Ryan, 1985; Ryan et al., 1983). The interest-enjoyment subscale is considered the self-report measure of intrinsic motivation. Although the overall questionnaire is called the IMI, it is only one of seven subscales in the IMI that assesses intrinsic motivation (Center for self-determination theory, 2022). Sample items included "I enjoyed this course very much" and "This course was fun to take." The items were scaled from 1 to 7 ranging from absolutely disagree to absolutely agree with a midpoint of neither.

Study effort was assessed by three items included in the IMI subscale termed "study effort" (Plant & Ryan, 1985; Ryan et al., 1983). The items were adapted to the CPR course. The three items were "I put a lot of effort into this course," "It was important to me to do well in this course" and "It was important to me to put effort into this course." One additional item that was constructed for this specific learning design was also included: "I actively took part in the discussions and reflection in this course." The items were scaled from 1 to 7 ranging from absolutely disagree to absolutely agree with a midpoint of neither.

Students' perceived learning outcomes, including theoretical knowledge, practical skills, and general competence, were assessed by 8 items (Appendix 1) that described the level of competency the students should achieve by the end of the course. The items were scaled from 1 to 5 ranging from not at all to very much.

The scales were assessed in the following order: (1) perceived teacher-autonomy-support, (2) intrinsic motivation, (3) study effort, and (4) perceived learning outcomes.

3.3. Ethics

The Management Unit at the actual university approved the study. This project did not require explicit permission regarding data protection according to the guide of the Data Protection Office for Research, Norwegian Social Science Data Service. Participation was voluntary, and all students were guaranteed anonymity. The students could choose to withdraw from the study at any time.

3.4. Statistical analysis

The data were analyzed by descriptive statistics using IBM SPSS version 28. The hypothesized relations between the latent constructs of students' Perceived Teacher-Autonomous-Support (PTAS), students' perceived Intrinsic Motivation (IM), students Study Effort (SE), and Perceived Learning Outcomes (PLO) were tested through SEM using Stata 17.1 (StataCorp, 2021). The use of SEM accounts for random measurement errors, and the psychometric properties of scales are therefore more precisely stemmed. Missing was handled by listwise deletion. Evidence indicates that the reliability coefficient of Cronbach's α alone is not a trustworthy estimator of reliability (Raykov, 2001). Hence, as shown in Table 2, the composite reliability coefficient based on the formula by Hair et al. (2010) was used; a coefficient of ≥ 0.7 is considered good, whereas a coefficient ≤ 0.6 is considered fair for both reliability coefficients (Crumbaugh, 1969; Reed, 1991; Reker, 1999). For the correlation analyses, the p-value was set to 1 %, whereas the estimates based in SEM analyses commonly include both 5 % and 1 % p-values. Commonly, factor loadings below 0.32 are considered poor, ≥ 0.45 are fair, ≥ 0.55 are good, ≥ 0.63 are very good, and > 0.71 are excellent (Sharma, 1996).

3.4.1. Model fit

Corresponding to the rule of thumb for conventional cut-off criteria (Schermelleh-Engel, 2003), we used the following fit indices to assess model fit: chi-square (χ^2) and its p-value, which is significant in most cases. A non-significant p-value indicates better fit. Therefore, rather than exclusively considering the χ^2 and its p-value, the literature suggests considering the value of χ^2/degrees of freedom (df), which should be ≤ 2 for a good fit and ≤ 3 for an acceptable fit (Jöreskog, 2000). In this study, skewness and kurtosis were significant. Therefore, we applied the Satorra-Bentler-scaled χ^2 statistic as a goodness-of-fit statistic, as this is the correct asymptotic mean even under non-normality (Jöreskog, 2000). Nevertheless, the χ^2 statistic is sensitive to sample size; therefore, researchers state that as a basis for acceptance or rejection of the model, the χ^2 cannot be solely relied upon (Schermelleh-Engel, Moosbrugger, & Müller, 2003; Vandenberg, 2006). Consequently, the use of multiple fit indices provides a more holistic view of the goodness of fit, accounting for sample size as well as model complexity and other relevant issues of the study. Hence, we used the root mean square error of approximation (RMSEA) and the standardized root mean square residual (SRMS) with values below 0.05 indicating good fit and values below 0.08 being considered acceptable (Hu & Bentler, 1998; Schermelleh-Engel, Moosbrugger, & Müller, 2003). Additionally, the comparative fit index (CFI) and the Tucker Lewis Index (TLI) were used to indicate an acceptable fit at 0.90 for both, and a good fit at 0.95 (Hu & Bentler, 1998; Schermelleh-Engel, Moosbrugger, & Müller, 2003). A proper power analysis rests on the ratio between the number of variables (error measurements, observed and latent variables) and the sample size; one observed variable per 10 participants is given as a rule of thumb (Brown, 2006; Kline, 2005; Schumacker & Lomax, 2004). The measurement models for the four latent constructs in the SEM were tested by CFA. To reduce model complexity of the SEM, a total of 22 indicator items were included: eight indicators for learning outcomes, four for intrinsic motivation, six for perceived teacher-autonomy-support, and four for study effort. When reducing the items per latent construct and thus model complexity, we considered the theoretical breadth and nuances of the actual construct along with the factor loadings and R^2-values (items that explain very little of the factor were dismissed).

4. Results

4.1. Descriptive analysis

Among the first-year nursing students from 2018 to 2021 (i.e., three different classes), 391 students participated, among whom 348 were female (89.1%), and 43 were male (10.9 %). The respondents consisted of 191 of the 229 (83.4 %) students from the 2019 class, 105 of the 250 (42 %) students from the 2020 class, and 95 of the 252 (36.5 %) students from the 2021 class. Table 1 presents the means, standard deviations (SD), Cronbach's alpha, and Pearson's correlation matrix of the latent variables included in the SEM. The correlations between the latent variables ranged from 0.32 to 0.58 in the expected direction. The a-levels for the various measures indicated an acceptable level of inter-item consistency, with Cronbach's alpha coefficients ranging from 0.74 to 0.87. Moreover, we investigated the associations between teacher-autonomy-support and the nursing students' intrinsic motivation, study effort, and learning outcomes in addition to the inter-relatedness between the dependent latent variables (intrinsic motivation, study effort, and perceived learning outcomes).

Table 1
The mean, Cronbach's alpha, and correlation coefficients between the study variables.

Construct	Mean (SD)	Items	Cronbach's Alpha	1	2	3	4
1. Perceived learning outcomes (1–5)	3.73 (0.62)	8	0.88	1			
2. Perceived teacher-autonomy-support (1–7)	5.69 (0.93)	6	0.84	.36**	1		
3. Intrinsic motivation (1–7)	5.64 (0.98)	4	0.87	.37**	.58**	1	
4. Study effort (1–7)	5.15 (0.94)	4	0.74	.32**	.42**	.53**	1

Note: * * p-value < 0.01. Listwise N = 368, Missing N = 23 (5.9%)

4.2. SEM-analyses – Model testing and model fit

To test the defined hypotheses, a SEM-model involving the four latent constructs and their 22 indicators was estimated. For scaling, the variances of the dependent latent variables were set at 1. All factor loadings were significant, showing fair to good estimates ranging from 0.46 to 0.86, with R^2 values between 0.21 and 0.74. Composite reliability was good, ranging between 0.76 and 0.87 (Fig. 2). Fig. 2 portrays the SEM model showing the measurement models with factor loadings, R^2-values, and composite reliability together with the structural model with the regression coefficients and fit indices. The SEM model yielded a good fit to the data ($\chi^2 = 348.95$, $p = 0.0001$, $df = 201$, $\chi^2/df = 1.74$, RMSEA = 0.045, p-close = 0.197, CFI = 0.95, TLI = 0.95, SRMR = 0.049). Table 2 shows the standardized regression coefficients of the directional relationships as well as the total (direct + indirect) effects between the latent constructs in the SEM model. As shown in Fig. 2, all hypotheses were significant, showing total effects by students' perceived teacher-autonomy-support on students' intrinsic motivation and perceived learning outcomes. Furthermore, the direct relationships between the dependent variables, as assumed in H4–H6, displayed significant values from students' intrinsic motivation to study effort and from study effort to learning outcomes (Table 2). When examining the indirect (mediated) effects displayed in Table 2, significant indirect effects from students' perceived teacher-autonomy-support to study effort (0.41**) and perceived learning outcomes (0.19 **) can be observed (H7). Total effects represent the sum of the direct and the indirect effects; Fig. 2 only shows the total effects between the latent variables, while all estimates (direct, indirect and total effects) are included in Table 2.

$$Compositereliability \rho_C = \frac{(\sum \lambda)^2}{(\sum \lambda)^2 + (\sum \theta)}$$

5. Discussion

The flipped classroom approach is considered useful for achieving the three basic needs of autonomy, perceived competence, and relatedness (McLaughlin et al., 2014; Phillips & O'Flaherty, 2019). This study used a learning design for CPR as a flipped classroom educational case. The aim of the study was to explore the associations between perceived autonomy-support by teachers and students' intrinsic motivation, study effort, and perceived learning outcomes. In doing so, we sought to contribute knowledge about key aspects that may enhance nursing students' learning in three ways. First, this study supplies empirical knowledge to the growing body of literature on the education of health professionals as well as to the evidence base concerning the flipped classroom approach. Second, by exploring first-year nursing students' intrinsic motivation, study effort, and perceived learning outcomes, this study provides empirical insight into the associations between perceived teacher-autonomy-support, intrinsic motivation, study effort, and learning. Third, by means of advanced statistical analysis such as SEM, this study suggests a guideline for teaching nursing students by promoting their autonomy, learning, and competence development. Finding ways to enhance students' intrinsic motivation seems to be efficient for their learning. More specifically, seven hypotheses were tested (Fig. 1), among which all were supported.

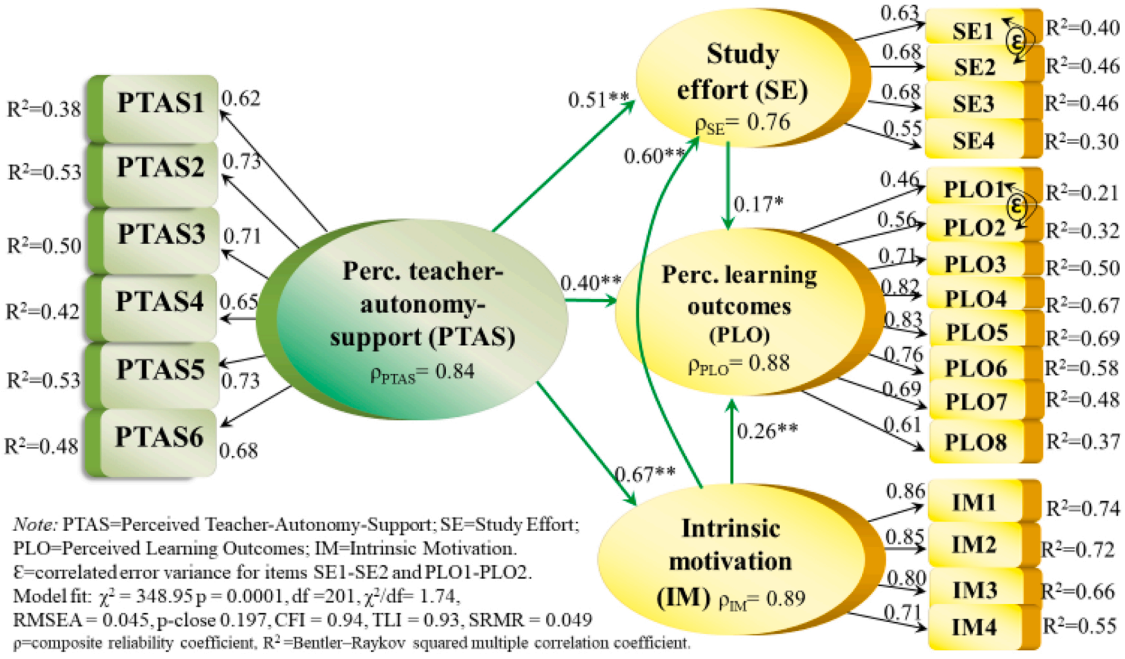

Fig. 2. The estimated SEM-model includes factor loadings, R^2 values, composite reliability, regression coefficients of the directional paths, and fit indices. Direct, indirect and total effects are listed in Table 2. The green arrows represent the total effects (Table 2) between the latent constructs.

Table 2
SEM model: direct and indirect relationships between teacher-autonomy-support, intrinsic motivation, effort, and perceived learning.

Constructs	Hypothesis parameter	[3]Direct effects estimate	t-value	Hypothesis	[4]Indirect effects estimate	t-value	[5]Total effects estimate	t-value
Intrinsic motivation								
Perceived teacher-autonomy-support	[1]γ 1,1 (H_1)	.67**	10.11				.67**	10.11
Study effort								
Perceived teacher-autonomy-support	γ 2,1 (H_2)	.11	1.30	(H_7)	.41**	5.72	.51**	7.00
Intrinsic motivation	[2]β 2,1 (H_4)	.60**	5.50				.60**	5.50
Perceived learning outcomes								
Perceived teacher-autonomy- support	γ 3,1 (H_3)	.21**	2.56	(H_7)	.19**	3.38	.40**	4.98
Intrinsic motivation	β 3,1 (H_5)	.16	1.68	(H_7)	.10	1.81	.26**	3.29
Study effort	β 3,2 (H_6)	.17*	2.00				.17*	2.00

Note. *Significant at the 5 % level, ** Significant at the 1 % level. [1]Gamma (γ): standardized regression coefficients representing direct relationships between the independent (teacher-autonomy-support) and dependent (intrinsic motivation, study effort, and perceived learning outcomes) latent constructs. [2]Beta (β): standardized regression coefficients representing direct relationships between the dependent latent constructs. [3]Direct effects representing the direct influence between the latent variables in the SEM model. [4]Indirect effects representing the influence of perceived teacher-autonomy-support mediated by intervening variables (mediators). [5]Total effects representing the total influence of the explanatory variable perceived teacher-autonomy-support on the dependent latent variables direct and indirect effects.

First, in the context of the flipped classroom approach, it was found that perceived autonomy-support by a teacher significantly influenced nursing students' intrinsic motivation (H1) and perceived learning outcomes (H3 and H7). This indicates that teachers who provide students with choices like doing the pre-class activities when they wish within a specific time frame positively enhance their intrinsic motivation to study and learn. This seems rational; providing options may communicate that the teacher acknowledges the students as real people and individuals, not just as objects or recipients of their teaching and transference of knowledge. In line with the flipped classroom philosophy as well as the SDT (Ryan & Deci, 2020) which emphasizes humans' basic needs of autonomy, competence, and relatedness, facing choices may stimulate students to feel counted on and thus comfortable to act and take part during the learning activities. Additionally, this way of approaching nursing students may facilitate a sense of competence among the students, which is motivating (Federici & Skaalvik, 2014; Ryan & Deci, 2017). Moreover, teachers' use of autonomy-supporting behavior can communicate that they are confident that the students will do well in the course and inspire them to ask questions. This is likely to encourage students' intrinsic motivation for learning the subject, especially when teachers encourage the three basic psychological needs of autonomy, perceived competence, and relatedness (Ryan & Deci, 2017; Ryan & Deci, 2020). Hence, autonomy-supporting behaviors by teachers can promote nursing students' intrinsic motivation and thereby their study effort and learning outcomes. This corresponds well with previous research indicating that the flipped classroom approach has an overall positive effect on students' learning achievement and learning motivation (Zheng et al., 2020).

Furthermore, our results suggest that autonomy-supporting behaviors by teachers, such as listening to students and providing them with choices about how they would like to perform procedures, can boost nursing students' intrinsic motivation. This can help nursing students feeling understood by their teacher and feel that the teacher is attempting to understand their perspective before correcting or suggesting other methods of performing the procedure, thus helping to make them more intrinsically motivated. When students feel listened to and understood and feel that the teacher is taking their point of view into consideration, the relatedness between the students and teacher is likely to grow. This represents a basic need (Ryan & Deci, 2017; Ryan & Deci, 2020). In line with a recent study showing that teacher facilitations enhanced nursing students' enjoyment and peer interaction (Cho et al., 2021), our findings signify that through autonomy-supporting behaviors, teachers can influence nursing students' experience of relatedness when learning. Furthermore, our findings indicate that autonomy-supporting behaviors by teachers can help students enjoy their learning process, enhance their interest in the subject, and help them to comprehend the usefulness of the course. From our point of view, this finding is crucial. The need for nurses in healthcare is steadily increasing. This trend is very likely to continue, as people worldwide are living longer (WHO, 2021). Many countries are now facing a shortage of registered nurses, and governments have urged for increased education in nursing. Consequently, it is and will continue to be important to provide efficient educational programs accompanied by efficient and competent teachers.

Second, the result of the present study indicates that perceived autonomy-support by a teacher has a significant direct and indirect (mediated) association with students' perceived learning outcomes as well as an indirect association with study effort. That is, teachers' autonomy-supporting behaviors seem to inspire nursing students to put more effort into the course, to try hard to do well, and to actively partake in the various learning activities. This finding is noteworthy, as it indicates that the teacher's role and behavior are exceptionally important to students' learning both directly and independently as well as mediated (indirectly) through intrinsic motivation and study effort.

Nursing students today are typically young adults, with many beginning their nursing education directly after high school. Because this study focused on first-year nursing students, most of the participants were young in three senses: they were young adults, young in terms of their knowledge of nursing, and young as university students. In this light, it is understandable that the teacher is perceived to be remarkably important. Moreover, the findings of this study indicate that students' intrinsic motivation significantly influenced their study effort (H4), which is in line with our expectation that study effort would result from motivation to learn (H4) and that study effort would positively impact students' perceived learning outcomes (H6). Both associations were found to be significant, in line with theory

and existing evidence (Bouwmeester et al., 2019; Fan et al., 2020; Kusurkar et al., 2013; Park & Park, 2018). Moreover, we expected that students' intrinsic motivation would relate significantly to their learning outcomes (H5); also, this path was found to be significant (Fig. 2).

The results indicate that intrinsic motivation significantly affects students' study effort. The more intrinsically motivated students are, the stronger their study effort is. The items that were used to assess intrinsic motivation included whether the learning activities were fun, enjoyable, and interesting. However, it is possible that the aspects of fun and enjoyment are less important to nursing students' learning, whereas usefulness for their function as nurses might be more critical. It is likely that adults studying nursing are intrinsically motivated by a wish to help and care for other people who are in need and are thus less concerned with whether the learning activities are fun and enjoyable. Notably, intrinsic motivation did not affect students' perceived learning outcomes directly (H5). Nevertheless, we found a very strong association between intrinsic motivation and study effort. This indicates that intrinsic motivation is also important for learning, mediated by study effort.

The perceived learning outcomes involved both theoretical knowledge about cardiac arrest, practical skills needed in CPR, competence in working under stress, and the ability to communicate precisely and make wise decisions in acute and complex situations. The ability to collaborate in acute and complex situations as well as the ability to act independently were also included together with ethical competence related to such situations (Mentzelopoulos et al., 2021). Most of the competencies listed above are not achieved by reading or studying texts for hours. Instead, they are attained by training and exercising together with peers and teachers.

When examining the learning outcomes specified above, the teacher's role and importance become even more visible. First-year nursing students are novices, and when novices develop new practical skills in a situation characterized by complexity and stress, a clear and competent leader is required. In the context of this study, the leader is the teacher. This may explain the outstanding significance of the teacher to these students' learning, motivation, and study effort. Previous research found that utilizing the flipped classroom approach, including both pre-class and in-class activities such as TBL, helped nursing students develop competence beyond gaining theoretical knowledge. By means of the flipped classroom approach, these students also developed collaborative skills and connected theoretical insight with real-life clinical scenarios (Choi et al., 2021). Furthermore, Park and Park (2018) found that in comparison to students who learned according to common teaching approaches, students who learned in a flipped classroom reached better academic achievement and critical thinking skills.

Thus, a guideline for teaching nursing students by finding ways to promote their autonomy, learning and competence development seems to be needed. By means of autonomy-supportive behavior, teachers may enhance students' motivation for learning as well as their study effort and learning outcomes. Teachers who provide students with choices like doing the pre-class activities when they wish within a specific time frame may positively enhance their intrinsic motivation to study and learn. Also, communicating to students that they are listening to them and taking their point of view into consideration may boost their intrinsic motivation and thereby their study effort and learning outcomes. This may encourage students to actively take part in the in-class learning activities. However, the opposite may also happen; to some students, freedom to find time to prepare may also result in not preparing. Therefore, a teacher who facilitates autonomy, relatedness, and perceived competence through a learning design that includes pre-class and in-class activities seems to be crucial.

5.1. Strengths and limitations

A notable strength of this study is its empirical examination of associations that have not been previously tested in this population. Moreover, the theoretical foundation of this study and its hypotheses were strong, utilizing questionnaires with good psychometric properties. The sample size of $N = 368$ is considered a large sample and well suited for SEM analysis (Brown, 2006; Hair et al., 2010). With $N = 368$, the model complexity could include about 36 items (ibid.). The present SEM included 22 items, indicating a strong statistical power of the tests. Using SEM accounts for random measurement errors, representing another strength of this study. Furthermore, the present sample represents three different segments (2019, 2020, 2021) of first-year nursing students at a large university in Norway, with a response rate ranging between 36.5 % and 83.4 %. Missing values were low in frequency.

However, some limitations must be kept in mind. The cross-sectional design does not allow for conclusions about causality. Hence, the directions of the estimated paths in the SEM-model must be interpreted with caution. A longitudinal design could offer an opportunity to test the causality, allowing for changes to be assessed and compared over time. Moreover, the use of self-reported data carries the undeniable risk that the findings may reflect common-method variance (Podsakoff et al., 2003). Despite a good model-fit, some alternative models might better fit the data or be more accurate. Nevertheless, the factor loadings, composite reliability, and the fit indices supported the present findings. Moreover, the flipped classroom approach involves that the students are expected to prepare beforehand the class. This study did not assess the students' experience of the workload related to the specific course; possibly demanding expectations of study effort could influence on their perceived autonomy-support by the teacher as well as their intrinsic motivation.

6. Conclusion

This study is based on a learning design using CPR as a flipped classroom educational case. The learning design includes both pre-class and in-class activities. The research question addressed whether perceived autonomy-support by teachers affects first-year nursing students' intrinsic motivation, study effort, and perceived learning outcomes. The aim of this study was to investigate the associations between perceived autonomy-support by teachers and students' intrinsic motivation, study effort, and perceived learning outcomes. Seven hypotheses were tested by means of SEM, supporting all the hypotheses.

This study contributes to knowledge of key aspects that may enhance nursing students learning. This study indicates that perceived autonomy-support by a teacher encourages first-year nursing students' intrinsic motivation, study effort, and perceived learning outcomes. Perceived autonomy-support by a teacher is significantly associated both directly and indirectly (mediated) with students' learning outcomes and indirectly associated with their study effort.

Our findings suggest that in a course with a flipped classroom approach, teachers should guide students in their learning and provide them with choices to enhance their motivation for learning. By means of autonomy-supportive behavior, teachers may enhance students' motivation for learning as well as their study effort and learning outcomes. Therefore, a teacher who facilitates autonomy, relatedness, and perceived competence through a learning design that includes pre-class and in-class activities seems to be crucial.

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Conflict of interest

The authors declare no conflict of interest.

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Appendix 1

The concepts, measurement items, means, and standard deviations (SD).

Concepts	Item	Mean	SD
Perceived teacher-autonomy-support	I feel that my teachers provide me with choices and options.	4.47	1.43
(1 = absolutely disagree, 7 = absolutely agree)	I feel understood by my teachers.	5.20	1.14
	My teachers conveyed confidence in my ability to do well in the course.	5.39	1.17
	My teachers encouraged me to ask questions.	5.53	1.19
	My teachers try to understand how I see things before suggesting a new way to do things.	4.58	1.40
	My teachers listen to how I would like to do things.	4.85	1.33
Intrinsic motivation	I enjoyed this course very much.	5.72	1.04
(1 = absolutely disagree, 7 = absolutely agree)	This course was fun to take.	5.76	1.03
	I thought this was a boring course (reversed).	5.40	1.35
	I would describe this course as very interesting.	5.63	1.15
Study effort	I put a lot of effort into this course.	4.99	1.23
(1 = absolutely disagree, 7 = absolutely agree)	I tried very hard to do well in this course.	4.71	1.37
	It was important to me to put effort into this course.	6.02	0.93
	I actively took part in the discussions and reflection in this course.	4.94	1.45
Perceived learning outcomes	Knowledge regarding situations in relation to cardiac arrest.	3.83	0.77
(1 = To a small extent, 5 = To a large extent)	Practical skills in CPR.	4.04	0.76
	Competence of working in stressful contexts.	3.37	0.99
	Competence in communicating precisely in CPR situations.	3.61	0.91
	Competence in engagement and decision-making in acute and complex situations.	3.70	0.84
	Cooperation skills in acute and complex situations.	3.97	0.79
	Ability to perform individually.	3.91	0.77
	Competence in ethical judgement in connection to CPR.	3.51	0.88

Appendix 2

Exploratory Factor Analysis of the variables included– Rotated Component Matrix. Estimates for factor loadings, and extraction sums of squared loadings.

Concepts	**Items**	**1.**	**2.**	**3.**	**4.**
PTAS1	I feel that my teachers provide me with choices and options.		.648		
PTAS2	I feel understood by my teachers.		.705		

(*continued on next page*)

(*continued*)

Concepts	Items	1.	2.	3.	4.
PTAS3	My teachers conveyed confidence in my ability to do well in the course.		.688		
PTAS4	My teachers encouraged me to ask questions.		.652		
PTAS5	My teachers try to understand how I see things before suggesting a new way to do things.		.783		
PTAS6	My teachers listen to how I would like to do things.		.753		
IM1	I enjoyed this course very much.		.372	.732	
IM2	This course was fun to take.			.756	
IM3	I thought this was a boring course (reversed).			.752	
IM4	I would describe this course as very interesting.			.696	
SE1	I put a lot of effort into this course.				.819
SE2	I tried very hard to do well in this course.				.801
SE3	It was important to me to put effort into this course.			.393	.616
SE4	I actively took part in the discussions and reflection in this course.		.334		.526
PLO1	Knowledge regarding situations in relation to cardiac arrest.	.559			
PLO2	Practical skills in CPR.	.639		.332	
PLO3	Competence of working in stressful contexts.	.732			
PLO4	Competence in communicating precisely in CPR situations.	.812			
PLO5	Competence in engagement and decision-making in acute and complex situations.	.825			
PLO6	Cooperation skills in acute and complex situations.	.761			
PLO7	Ability to perform individually.	.721			
PLO8	Competence in ethical judgement in connection to CPR.	.640			
	Cumulative % of total variance explained	33.958	46.744	54.511	59.949

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Values< 0.32 are suppressed. Four components extracted based on Eigenvalue >1. Total variance explained: 59.949. Rotation converged in 5 iterations. Listwise N = 368

Appendix C. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.lmot.2022.101856.

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