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The role of competence and autonomy support in instructor motivation: a path model in Norwegian higher education

Marius O. Johansen[a], Lucas M. Jeno[a] and Sehoya H. Cotner[b]

[a]Department of Education, University of Bergen, Bergen, Norway; [b]Department of Biological Sciences, University of Bergen, Bergen, Norway

ABSTRACT

Higher education institutions increasingly emphasize autonomy-supportive teaching, yet little is known about how instructors' perceived competence and the autonomy support they receive from institutional leadership jointly shape their motivation and teaching-related intentions. Drawing on Self-Determination Theory, this study addresses this gap by examining how perceived autonomy support and competence relate to intrinsic motivation, external regulation, autonomy-supportive teaching behaviors, and teaching intentions among university instructors. Using national survey data from 136 biology instructors in Norway, we tested a path model assessing these relationships. Structural equation modeling showed that perceived competence strongly predicted intrinsic motivation, which in turn positively predicted teaching intentions, while external regulation negatively predicted teaching intentions. Contrary to theoretical expectations, perceived autonomy support from leadership was unrelated to intrinsic motivation or external regulation. Competence also directly predicted autonomy-supportive teaching behaviors, whereas motivational pathways did not. The results indicate that competence acts as a central driver of instructor motivation. The findings suggest that faculty development initiatives that strengthen instructors' perceived teaching competence may be a particularly effective lever for enhancing motivation and teaching intentions in higher education.

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For the past three decades, research on motivation has linked students' motivation to higher academic achievements (Feri et al., 2016), effort (Howard et al., 2021), engagement (Vansteenkiste et al., 2018), psychological well-being (Howard et al., 2021), reduced dropout intentions (Calvo et al., 2010), and lower levels of stress and depressive symptoms (Huang et al., 2016). Given the apparent importance of student motivation, research has often emphasized the teacher's role in the classroom as a key factor in fostering motivation (see e.g. Alley, 2019; Cheon et al., 2018). Yet, despite the growing body of research on educators' roles in facilitating student motivation, studies on *instructor motivation* in higher education remain scarce (see e.g. Hanfstingl et al., 2010; Nie et al., 2015; Yano, 2024). The lack of systematic attention to instructors' motivation represents an important research gap. Instructors' own experiences are critical determinants of how they interact with students and, consequently, how students become motivated (Vansteenkiste et al., 2018). This study therefore examines how perceived support from academic leadership affects instructor motivation and, in turn, their future teaching intentions and teaching style. We draw on Self-Determination Theory (SDT; Ryan & Deci, 2017) to investigate these relations among higher education biology lecturers in Norway. Instructor motivation has been studied from several theoretical perspectives in educational and organizational psychology. Expectancy-Value Theory emphasizes teachers' beliefs about their likelihood of success and the value they assign to instructional tasks (Loh, 2019; Wigfield & Eccles, 2000). Achievement Goal Theory highlights motivational orientations toward mastery or performance outcomes (Jiang & Zhang, 2021). Occupational models, such as the Job Demands–

CONTACT Marius O. Johansen marius.johansen@uib.no Department of Education, University of Bergen, Bergen, Norway

Resources framework, conceptualize teacher engagement as emerging from the balance between work demands and available resources (Evers et al., 2016). Self-efficacy theory similarly focuses on teachers' confidence in their instructional capabilities (Cao et al., 2020; Skaalvik & Skaalvik, 2018). While these frameworks offer important insights, SDT provides a particularly coherent account of how instructors' social environments support—or thwart—internal motivation, making it well suited for the constructs assessed in the present study (Han & Yin, 2016).

Here, we examine how two key SDT predictors, autonomy support from leadership and perceived competence, relate to instructors' intrinsic motivation and external regulation. We further investigate how these motivational processes are linked to two important outcomes; autonomy-supportive teaching behaviors and future teaching intentions. Based on SDT, we hypothesize that autonomy support and competence will positively predict intrinsic motivation (and negatively predict external regulation), and that these motivational types will differentially relate to instructors' behaviors and intentions.

SDT and motivation

SDT is a theory of human motivation and psychological well-being (Ryan & Deci, 2017). At its core, SDT posits that humans have three basic psychological needs; relatedness (feeling connected to others), competence (feeling effective), and autonomy (feeling self-endorsed). The quality and type of motivation depends on the satisfaction of these needs (Chen et al., 2015). According to SDT, motivation consists of different types, each with unique characteristics, that can be ordered along a continuum (Ryan & Deci, 2017). These motivational regulations vary in autonomy (Chen et al., 2015), ranging from the most autonomous (intrinsic motivation and identified regulation) to least the autonomous (introjected regulation and external regulation).

Intrinsic motivation occurs when an individual engages in an activity because it is inherently enjoyable, satisfying, or interesting (Ryan & Deci, 2017). Intrinsically motivated instructors are naturally drawn to teaching out of curiosity, interest, and pleasure (Vansteenkiste et al., 2018). Research shows that such instructors are more likely to adopt autonomy-supportive teaching practices, e.g. refocusing uninteresting activities, identifying students' personal interests, and providing choices and rationales (Vansteenkiste et al., 2018; Zou et al., 2024). They also report higher psychological well-being (Cece et al., 2022; Nie et al., 2015; Slemp et al., 2020) and lower burnout (Eyal & Roth, 2011; Van den Berghe et al., 2014).

External regulation, in contrast, occurs when instructors engage in teaching primarily to meet expectations, avoid negative consequences, or gain approval (Reeve & Cheon, 2021). Externally regulated instructors are more prone to burnout (Caruso, 2019), experience lower psychological well-being (Cece et al., 2022; Nie et al., 2015; Slemp et al., 2020), and show higher turnover intentions (Skaalvik & Skaalvik, 2018). They also tend to adopt controlling teaching styles (Bureau et al., 2022), which are linked to negative student outcomes such as higher anxiety, lower engagement, higher dropout intentions, and reduced academic achievement (Cheon et al., 2018; Howard et al., 2021; Vansteenkiste et al., 2018). Thus, investigating the motivational dichotomy between intrinsic motivation and external regulation among higher education instructors is crucial, not only for ensuring instructor well-being but also for promoting high-quality education for students (Reeve & Cheon, 2021). The present study focuses on intrinsic motivation and external regulation, as they represent the two polar opposites on the motivation continuum, making them particularly distinct and easier to detect in quantitative research (Ryan & Deci, 2017). While intermediate forms of regulation (e.g. introjected and identified) provide nuance, they often covary with adjacent types—introjected with external regulation, identified with integrated regulation—making the contrast between fully autonomous and fully controlled motivation especially relevant (Howard et al., 2021).

The effect of autonomy supportive leaders on instructors' motivation

Autonomy-supportive leadership in higher education encompasses a set of supervisory actions that foster an environment of encouragement and empathy between leaders and instructors (Zhang et al., 2021). Such leadership is essential in sustaining intrinsic motivation and a productive environment (Eyal & Roth, 2011; Slemp et al., 2020). Institutional leaders can support autonomy by providing instructors with flexibility in course design, assessment strategies and teaching methods (Desmarais & Grenier, 2023). They can

also involve instructors in decision-making processes that affect their professional development, such as curriculum design, academic policies, and resource allocation (Eyal & Roth, 2011). In a qualitative study by Keddie et al. (2024), instructors at an Australian college reported that reducing micromanagement by leadership was imperative in promoting an autonomy-supportive environment. Similar results have been found by others (e.g. Narayanan et al., 2024). Quantitative evidence further supports these observations. In China, Nie et al. (2015) found that autonomy support from leadership was a strong predictor of instructors' intrinsic motivation. Austrian teachers showed similar results in a nationwide study by Hanfstingl et al. (2010). More recently, Yano (2024) demonstrated that satisfying instructors' need for autonomy predicted intrinsic motivation among teachers in Laos. In contrast, research indicates that instructors who receive low autonomy support from leadership exhibit higher levels of controlled motivation in their teaching (see e.g. Orsini et al., 2020; Slemp et al., 2020; Van den Berghe et al., 2014).

The effect of competence on instructors' motivation

According to SDT, satisfying the basic need for competence is essential constituents for fostering motivation and well-being in instructors, where teaching activities are fueled by intrinsic vigor rather than experiences as energy-depleting (Ryan & Deci, 2017). In higher education, instructors feel competent when they are effective and successful in their teaching (Slemp et al., 2020). This often motivates them to seek further growth opportunities, such as attending seminars, workshops, or courses to improve their pedagogical approaches (Chiu et al., 2021). This sense of competence often arises when students show understanding of the learning material, perform well on assessments, and apply knowledge in meaningful ways to solve difficult tasks and assignments (Ryan & Deci, 2017). Research shows that instructors who feel competent experience higher levels of autonomous motivation (Sørebø et al., 2009).

Instructors can also develop a sense of competence through recognition and feedback from peers or department leadership (Brenner, 2022). Constructive evaluations, recognition, and informal praise for their teaching methods can enhance their confidence and sense of mastery, satisfying instructors' inherent need for competence as they feel their skills are acknowledged and appreciated (Doo et al., 2020).

The effect of intrinsic motivation on teacher behaviors and intentions

Intrinsic motivation plays a crucial role in shaping instructors' teaching intentions and autonomy-supportive teaching behaviors (Vansteenkiste et al., 2018). In higher education, intrinsically motivated instructors are more likely to invest time and effort in improving their teaching practices (Ryan & Deci, 2017). They engage in professional development activities such as attending seminars, exploring new teaching strategies, and embracing pedagogical innovations (Chiu et al., 2021; Snoek et al., 2019). Moreover, intrinsically motivated instructors tend to adopt autonomy-supportive teaching behaviors, fostering students' autonomy and intrinsic motivation (Guay, 2022). A cross-sectional study by Liu et al. (2019) found that autonomous motivation directly predicted autonomy-supportive teaching behaviors among instructors in Singapore. Similar results were reported by Zou et al. (2024), showing that intrinsic motivation predicted autonomy-supportive teaching styles among middle school teachers in Beijing. Teaching intentions, such as the desire to improve teaching skills or engage in professional development, are also influenced by motivation (Purwanti & Octavia, 2023). Intrinsically motivated instructors are more likely to develop strong intentions for self-improvement and engage in reflective practices aimed at enhancing teaching effectiveness (Zhang et al., 2021). Yang (2021) found the same pattern among over 400 university lecturers in China, showing intrinsic motivation as a key predictor of future teaching intentions.

Present study

This study aims to investigate how autonomy support from leadership and experiences of competence influence motivation, teaching behavior, and intentions among higher education instructors. Building on the tenets of SDT, we hypothesize that (1) higher levels of autonomy support from institutional leaders and experiences of competence will positively influence instructors' intrinsic motivation and be

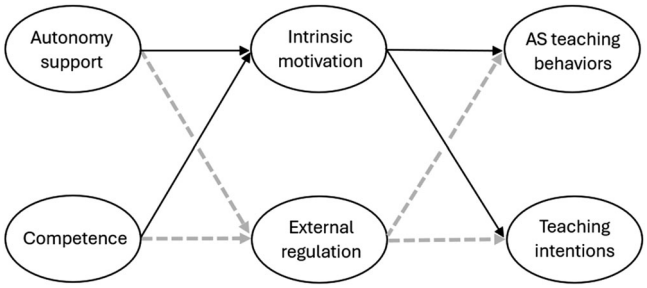

Figure 1. Path model depicting the hypothesized relations of the variables.
Note: AS teaching behaviors = Autonomy supportive teaching behaviors. Solid lines indicate a positive relationship; dotted lines indicate a negative relationship.

negatively associated with external regulation; (2) intrinsic motivation will predict autonomy-supportive teaching behaviors and teaching intentions; and (3) external regulation will be negatively linked to autonomy-supportive teaching behaviors and teaching intentions (Figure 1). As illustrated in Figure 1, autonomy support from institutional leaders and instructors' experiences of competence are positioned as antecedents to motivational regulation. Consistent with SDT, these contextual and psychological resources are expected to foster intrinsic motivation while reducing external regulation (Ryan & Deci, 2017). In turn, intrinsic motivation is hypothesized to promote autonomy-supportive teaching behaviors and stronger intentions to invest in one's teaching practice, whereas external regulation is expected to show the opposite pattern. This model reflects SDT's core proposition that high-quality motivation emerges when basic psychological needs are supported, ultimately shaping educators' behaviors and future engagement.

Although previous research has investigated the role of autonomy support and competence in instructor motivation, few studies have explored the dual dichotomy of intrinsic motivation versus external regulation in relation to instructor behavior. Thus, we contribute to the current literature. Unlike previous studies (e.g. Hanfstingl et al., 2010; Jensen & Bro, 2018), our study examines how both intrinsic motivation and external regulation relate to teaching intentions and autonomy-supportive teaching styles. Next, in contrast to Nie et al. (2015) and Eyal and Roth (2011), we investigate a more comprehensive structural equation model as we include competence and autonomy support as motivational predictors in the model. Although relatedness is a fundamental psychological need in SDT, this study focuses on autonomy and competence, as these needs have been shown to be strong predictors of intrinsic motivation in professional and educational contexts, whereas relatedness plays a more distal role (Ryan & Deci, 2017). Finally, although studies on instructor motivation span many countries, research into Scandinavian contexts is lacking (see e.g. Slemp et al., 2020; Sørebø et al., 2009). The Norwegian context is especially relevant because universities operate within a governance system that emphasizes autonomy, trust-based management, and relatively high instructor independence in course design and assessment. At the same time, recent reforms in Norwegian higher education have increased administrative demands and accountability structures, potentially shaping how instructors perceive leadership support and their own sense of competence (Ministry of Education and Research, 2017). These contextual dynamics make Norway a valuable case for testing SDT-based predictions about autonomy support, competence, and instructor motivation. Thus, this study makes an important contribution to literature by simultaneously examining how autonomy support and competence influence intrinsic motivation and external regulation, and, in turn, key instructor behaviors.

Methods

The present study focuses exclusively on university-level biology instructors because the data originate from a nationwide discipline-specific survey developed by bioCEED, Norway's Centre of Excellence in Biology Education. The survey was designed to map teaching practices, motivation, and perceptions of learning environments within biology programs across all major Norwegian institutions, and it serves as a follow-up to the 2015 bioCEED Survey. As such, the sampling frame was intentionally restricted to instructors teaching in biology to enable detailed, field-specific insight into motivational processes in this disciplinary context. While biology instructors share many characteristics with instructors in other

STEM and higher-education fields, disciplinary norms, teaching practices, and work demands may differ across domains. The present focus therefore provides valuable, coherent insight into instructor motivation within one well-defined educational field, though generalizations to other disciplines should be made with appropriate caution.

Participants

The survey was distributed to instructors at all major Norwegian institutions offering biology education, including the University of Bergen (UiB), the University Centre in Svalbard (UNIS), the Norwegian University of Science and Technology (NTNU), UiT The Arctic University of Norway, the Norwegian University of Life Sciences (NMBU), the University of Oslo (UiO), the University of Agder (UiA), Nord University (UiN), and the University of South-Eastern Norway (formerly HSN/Telemark University College). Thus, the sample reflects a broad cross-section of biology programs across research-intensive universities and university colleges. As participation was voluntary, responses may be influenced by institutional response rates or individual willingness to engage in pedagogical surveys. Although the broad institutional coverage reduces concerns about structural underrepresentation, the possibility of sampling bias (such as greater participation from instructors with strong pedagogical interest or motivation) should be acknowledged when interpreting the findings.

This study included 136 higher education biology instructors (42.6% females, 54.4% males, 3.0% preferred not to disclose gender). To ensure anonymity, age was recorded in intervals: 2.2% were under 29; 5.9% were 30–39; 32.4% were 40–49; 35.3% were 50–59, 24.3% were 60 or older.

Procedure

The sampling strategy followed a census-style approach in which all eligible university instructors teaching biology courses were invited to participate. Institutional management at each participating university and university college was first contacted to obtain permission for data collection and to provide contact information for relevant instructors. Teachers were defined broadly to include permanent and temporary staff, adjunct faculty, and others with formal teaching responsibilities in biology education. An initial screening item ensured that only respondents with active teaching duties proceeded; individuals reporting no teaching responsibilities were excluded. Invitations to the online SurveyXact questionnaire were distributed via institutional email lists. Participation was voluntary and anonymous, and no financial or material incentives were offered. As participation was voluntary, non-response bias cannot be ruled out; instructors with greater interest in teaching or pedagogical research may have been more likely to respond (Groves & Peytcheva, 2008). Respondents were informed that their answers would be treated confidentially and would not affect their relationship with their institution. To maximize participation, the questionnaires were provided in both Norwegian and English (Rittase et al., 2020). A native English-speaker translated the original Norwegian items, followed by a back-translation by the authors to ensure that the meaning of the items remained consistent in both languages (Harkness & Schoua-Glusberg, 1998). Both temporary and permanent faculty members with teaching duties as part of their job description were invited to participate in the study. A control question was included in the survey to ensure that all participating instructors had teaching responsibilities.

Several ethical considerations were taken in this study. First and foremost, the study received formal ethical approval from the Norwegian Centre for Research Data (NSD). Next, the institutional management at all participating institutions was contacted before data collection to obtain permission for instructors to participate. Further, the participants were informed that they could withdraw at any given time, that participation was voluntary, and that all responses were treated confidentially and registered anonymously.

Measures

Autonomy support

Six items from the shortened Learning Climate Questionnaire (Williams et al., 1994) were adapted to measure instructors' perceived autonomy support from authority figures. For these items and the

following constructs, participants responded on a 7-point Likert scale, ranging from 1 (not true at all) to 7 (very true). An item example is 'I feel that my leaders give me choices and opportunities related to my teaching'. Previous research has demonstrated the scale's reliability (Núñez et al., 2012), and the Cronbach's alpha for the current study was $\alpha = .92$.

Competence

Four items from The Perceived Competence Scale (PCS; Williams et al., 1994) were adapted to measure instructors' perceived teaching competence. An item example is 'I feel confident in my ability to teach this material'. Previous research has demonstrated good internal consistency (Martin et al., 2017), and Cronbach's alpha in this sample was $\alpha = .86$.

Teachers' motivation

Six items from the Work Tasks Motivation Scale for Teachers (WTMST; Fernet et al., 2008) were used to assess instructors' intrinsic motivation and external regulation. The participants were presented with the statement 'Why do you teach?' followed by three items measuring intrinsic motivation (e.g. 'Because I enjoy teaching') and three items measuring external regulation (e.g. 'Because I'm paid to do it'). Previous research has shown that the scale is reliable (Fernet et al., 2008). Cronbach's alphas for the current study were $\alpha = .93$ (intrinsic motivation) and $\alpha = .75$ (external regulation).

Autonomy supportive teaching behaviors

Three items were used to measure autonomy supportive teaching behaviors for the study, focusing on facilitation of questions/discussions in the classroom and the provision of rationale by combining practice and theory in the respondents' teaching practices. An item example is 'I facilitate discussions between students in my teaching'. Cronbach's alpha for the current study was $\alpha = .66$, which is somewhat low but acceptable according to traditional conventions (Kerlinger, 1964).

Teaching intentions

Four items were adapted from Reeve et al. (1999) and the Theory of Planned Behavior (Ajzen, 1991) to measure teaching intentions. An item example is 'I want to spend more time on planning and facilitating my teaching'. The Cronbach's alpha was $\alpha = .67$, which, while low, is still within the acceptable range (Kerlinger, 1964).

Statistical analysis

Statistical analysis was performed using the open-source software RStudio version 2023.03.1. The 'lavaan' package was used to assess the measurement model and the structural equation model (SEM). The traditional fit indices Standardized Root Mean Squared Residual (SRMR), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA) were used to assess model fit. The SRMR index measures badness-of-fit, represented by the square-root of the average difference in residuals between the observed and hypothesized model correlation matrices (Kline, 2011). The CFI represents the amount of fit misspecification between a proposed model and a null model (Bentler, 1990). The TLI is an incremental fit index measuring the relative amount of reduction in misspecification per degree of freedom. The RMSEA index measures the estimated discrepancy between the sample data and the model covariance matrix per degree of freedom. Good model fit is conventionally indicated by the fit values SRMR $< .08$, CFI $> .90$, TLI $> .90$, and RMSEA $< .08$ (Shi et al., 2019).

Results

Descriptive analysis

Missing data were found in 9% of the 136 participants. Little's Missing Completely at Random (MCAR) test revealed no systematic bias in the missing data ($p > .05$). Thus, missing data were imputed using the Multivariate Imputations via Chained Equations (MICE) algorithm (Azur et al., 2011).

Table 1. Descriptive statistics of the main variables.

	M	SD	Range	Skewness	Kurtosis	α
Intrinsic motivation	5.86	1.09	1–7	−1.32	2.69	.93
External regulation	3.97	1.53	1–7	.03	−.33	.75
Competence	5.74	.82	1–7	−.59	.67	.86
Autonomy support	4.73	1.25	1–7	−.48	.33	.92
AS teaching	5.40	.83	1–7	−.19	−.13	.66
Teaching intentions	4.84	.79	1–7	−.66	1.37	.67

Note: AS teaching = Autonomy supportive teaching behaviors.

Table 2. Correlations of the main variables.

	1	2	3	4	5
1. Intrinsic motivation					
2. External regulation	−.14				
3. Competence	.60**	−.21*			
4. Autonomy support	.09	.02	.07		
5. AS teaching	.18*	−.07	.32**	.01	
6. Teaching intentions	.19*	−.06	.08	−.11	.15

Note: $^{*}p < .05$, $^{**}p < .01$. AS teaching = Autonomy supportive teaching behaviors.

Table 3. Standardized factor loadings from the CFA model.

Latent variable	Item	Std. loading
Autonomy support	s_33	.724
	s_34	.839
	s_35	.759
	s_36	.749
	s_37	.896
	s_36	.860
Intrinsic motivation	s_169	.925
	s_170	.913
	s_174	.884
External regulation	s_172	.604
	s_173	.918
	s_174	.696
Teaching intentions	s_146	.542
	s_147	.654
	s_148	.545
	s_149	.667
Competence	s_67	.844
	s_68	.572
	s_69	.807
	s_70	.741
Being autonomy supportive	s_44	.655
	s_45	.702
	s_46	.535

Descriptive analyses are given by Table 1. Shapiro-Wilk tests indicate that the variables are approximately normally distributed. Intrinsic motivation is slightly leptokurtic, with a kurtosis value of 2.69, but is still within the conventional limits (Byrne, 2010). Correlational analyses (Table 2) show that intrinsic motivation is positively correlated with competence, teaching intentions, and autonomy supportive teaching behaviors. External motivation is negatively correlated with competence, while competence is positively correlated with autonomy supportive teaching behaviors. No significant correlations were found with autonomy support. The questionnaire included a control for the completion of basic university pedagogics training, and t-tests revealed no significant differences in the means of the variables of interest between these groups (all p-values >.05).

SEM analysis

We used SEM to test our main hypothesis, i.e. perceived autonomy support and competence predict instructor motivation, which in turn relates to teaching intentions and autonomy-supportive teaching behaviors. Results from a confirmatory factor analysis are given by Table 3. The SEM results are presented in Figure 2. Analysis of the initial measurement model indicates adequate factor loadings and

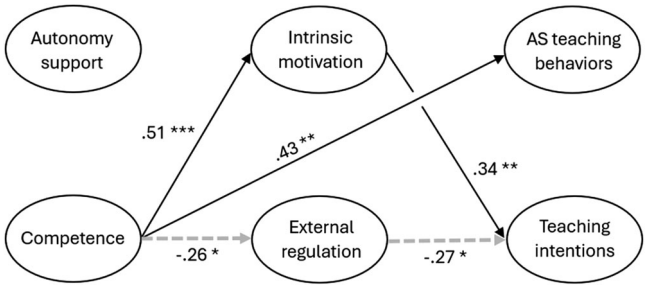

Figure 2. Path diagram with standardized regression coefficients.
Note: AS teaching behaviors = Autonomy supportive teaching behaviors. Solid lines indicate positive relationships, dotted lines indicate negative relationships. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. Non-significant paths have been removed from the model.

Table 4. Indirect effects of the relationships of the SEM model.

Independent variable	Mediator	Dependent variable	Indirect effect	CI	z	p-value	β^{*}
Autonomy support	Intrinsic motivation	AS teaching behaviors	.004	−.011, .014	.41	.67	.001
Autonomy support	Intrinsic motivation	Teaching intentions	.004	−.023, .031	.42	.68	.013
Autonomy support	External regulation	AS teaching behaviors	.000	−.036, .035	−.22	.82	−.005
Autonomy support	External regulation	Teaching intentions	.002	−.020, .039	.24	.80	.017
Competence	Intrinsic motivation	AS teaching behaviors	.001	−.071, .103	−.23	.82	.012
Competence	Intrinsic motivation	Teaching intentions	.173	.010, .224	2.62	.03*	.178
Competence	External regulation	AS teaching behaviors	.004	−.001, .004	.19	.81	−.022
Competence	External regulation	Teaching intentions	.070	.015, .121	1.99	.04*	.078

Note: AS teaching behaviors = Autonomy supportive teaching behaviors. $^{*}p < .05$, β^{*} = standardized effect size.

model fit, with SRMR = .07 (90% CI: .06, .08), CFI = .94, TLI = .93, and RMSEA = .06 (90% CI: .04, .07). The full SEM model also produced good fits, with SRMR = .08 (90% CI: .07, .10), CFI = .95, TLI = .94, and RMSEA = .06 (90% CI: .04, .08). Multicollinearity was assessed using variance inflation factors (VIFs). All predictors showed acceptable levels of multicollinearity (VIFs < 9; Hair et al., 1995), well below commonly used thresholds (e.g. VIF < 10), indicating that multicollinearity was not a concern in the model.

Specifically, the results indicated that competence positively predicted intrinsic motivation and was negatively related to external regulation. Next, in line with our hypothesis, intrinsic motivation positively predicted teaching intentions, but we found no significant relationship to autonomy-supportive teaching behaviors. In line with our hypothesis, external regulation negatively related to teaching intentions, but no significant relationship with autonomy-supportive teaching behaviors was observed. Notably, competence was identified to be a strong predictor of autonomy-supportive teaching behaviors. Finally, contrary to our initial hypotheses, we found no significant relationship between perceived autonomy support and either intrinsic motivation or external regulation.

To further explore the relationships between competence, motivation, and teaching-related behaviors, an indirect effect analysis was conducted (Table 4). We include completely standardized effect sizes (β^{*}) and bootstrapped 95% confidence intervals for each indirect effect. Effect sizes offer information about the practical importance of each association (i.e. how large the effects are in standard-deviation units), and model fit indices summarize how well the overall SEM model reproduces the observed covariance patterns (Kline, 2011).

The results indicate that autonomy support did not exhibit any significant indirect effects on either autonomy supportive-teaching behaviors or teaching intentions through intrinsic motivation or external regulation (all p-values > .67). This finding aligns with the structural model, where autonomy support did not show significant direct relationships with any variables.

In contrast, competence positively predicted teaching intentions through both intrinsic motivation and external regulation. Specifically, the indirect effect of competence on teaching intentions through intrinsic motivation was significant, suggesting that instructors who felt more competent were more likely to experience higher intrinsic motivation, which, in turn, predicted stronger teaching intentions. Similarly, competence exhibited a significant indirect effect on teaching intentions via external regulation, though with a smaller effect. The direction of this relationship aligned with the structural model, where competence negatively predicted external regulation, and external regulation negatively predicted

teaching intentions, indicating that lower external regulation may facilitate greater engagement in professional development activities.

However, no significant indirect effects were observed for competence on autonomy supportive teaching behaviors, whether mediated by intrinsic motivation ($p = .82$) or external regulation ($p = .81$). This suggests that while competence is a key driver of intrinsic motivation, which in turn fosters greater teaching intentions, its influence on actual teaching behaviors may not operate through these specific motivational pathways.

A post-hoc power analysis was conducted to assess the statistical power of the structural equation model using Monte Carlo simulations. The analysis was performed with the 'simsem' package in R, which generated 1,000 simulated datasets based on the model's original specifications. The results of the power analysis indicated that the model exhibited excellent fit across the commonly used model fit indices. The RMSEA had a mean value of .02 which is well below the accepted threshold of .08, indicating an excellent fit. Similarly, the SRMR had a mean value of .056, which is below the typical threshold of .08, further supporting the model's good fit. Further, the CFI yielded a mean value of .98, comfortably above the recommended threshold of .90, thus suggesting a very good fit. Likewise, the TLI had a mean value of .96, again exceeding the cut-off of .90, providing further evidence of the model's adequacy.

Discussion

The main aim of the present study was to investigate a structural model to test whether autonomy support from academic leadership and experiences of competence predicted motivation, and, in turn, teaching intentions and teaching behaviors. In general, the results supported our hypothesis, albeit with a few noteworthy exceptions.

Experiences of competence positively predicted intrinsic motivation and negatively predicted external regulation, consistent with SDT's tenets that competence satisfaction is necessary for intrinsic drive (Ryan & Deci, 2017). Similar findings have been reported in cross-sectional studies among teachers in Belgium and Greece (Kaldi & Xafakos, 2017; Van den Berghe et al., 2014). When instructors' competence needs are met, they engage in teaching with volition; when thwarted, they may rely on external motivators. In contrast with our hypothesis, we found no significant relationship between intrinsic motivation and autonomy-supportive teaching behaviors. We had predicted that when teachers are intrinsically motivated, they would find deep joy and purpose in the act of teaching itself, and autonomy-supportive practices would resonate naturally with them because they reflect their own volitional experiences. However, and as opposed to previous studies which have found that intrinsic motivation for teaching relates to autonomy-supportive teaching behaviors (e.g. Orsini et al., 2020; Zou et al., 2024), we found no significant relationship between these factors. One reason could arise from the structure of some of these university courses, where up to 200 students attend the same lecture. Such large courses may give some instructors the impression that their ability to support autonomy is constrained, thus impeding the facilitation of student agency. However, these are mere speculations, and more research is needed to confirm our findings.

In line with hypotheses, intrinsic motivation positively predicted teaching intentions, whereas external regulation was negatively related. These findings align with prior studies (Liu et al., 2019; Yang, 2021; Zhang et al., 2021) and illustrate how different motivational types influence instructors' engagement with professional development. Instructors driven by intrinsic motivation are more likely to pursue self-improvement, whereas those operating under external regulation may engage only when tied to rewards or institutional requirements (Purwanti & Octavia, 2023; Ryan & Deci, 2017). In contrast, external regulation, which is fueled by external contingencies, is less congruent to authentic engagement like teaching development. Instructors operating under external regulation may perceive professional development activities as burdensome or unnecessary unless they are tied directly to rewards, such as an increased salary, promotions, or compliance with institutional policies (Ryan & Deci, 2017). Because their motivation is not inherently tied to the activity of teaching itself, they may lack the internal drive to seek out or meaningfully engage in opportunities to improve their teaching.

Finally, we found no significant relationship between autonomy support from leadership and intrinsic motivation among instructors. While several factors may contribute to this pattern, these interpretations

should be considered tentative. One plausible explanation is rooted in the nature of the academic profession itself. University instructors often operate with a high degree of professional freedom, which may result in a consistently high baseline of perceived autonomy. If autonomy is already embedded in their role, additional autonomy-supportive behaviors from leadership may have limited incremental impact on their motivation. Another possibility is that instructors' intrinsic motivation is primarily driven by their interest in their academic discipline rather than by contextual leadership behaviors. This aligns with qualitative findings by Ansyari et al. (2019), in which intrinsically motivated lecturers attributed their motivation mainly to their fascination with their field rather than to autonomy-supportive leadership. However, alternative explanations should also be considered. For instance, the measurement of autonomy support might not fully capture the types of autonomy-relevant support that matter most in higher education settings, or instructors may interpret leadership behaviors differently depending on departmental culture or disciplinary norms. Additionally, it is possible that the link between autonomy support and intrinsic motivation varies across educational levels, as studies among K–12 teachers have found significant associations (Cece et al., 2022; Power & Goodnough, 2019; Slemp et al., 2020). The lack of a significant relationship between autonomy support and intrinsic motivation in our study may reflect the unique context of higher education, where autonomy is often already embedded in the role, and intrinsic motivation is driven more by internal factors (Ryan & Deci, 2017).

Our findings suggest several practical recommendations. For example, institutions could support instructors' teaching competence by providing structured professional development, mentorship programs, or feedback systems aligned with intrinsic motivation. Such interventions may help foster motivation and strengthen the pathways identified in our SEM model. While the present study was grounded in SDT, our findings also resonate with broader educational research on teaching effectiveness and professional development. For example, studies outside the SDT tradition emphasize that instructors' perceived competence, autonomy, and support systems play key roles in shaping teaching intentions and behaviors (see e.g. Asing-Cashman et al., 2014; Evers et al., 2016; Lauermann & ten Hagen, 2021; Lin & Gao, 2023). This suggests that the pathways identified in our model may have relevance beyond SDT-specific interpretations, highlighting the general importance of fostering competence and motivation in higher education teaching contexts.

Limitations

There are several limitations worth considering when interpreting the results from our study. First, our study was based on cross-sectional data. Despite our study being based on SEM model and theory, we have no way of controlling for a temporal component or claiming causality. We recommend future studies using longitudinal data to further understand how motivation over time changes and affects teaching behavior and intentions. Second, our sample size was somewhat low. However, our model's data to variable ratio was acceptable ($>20^*$number of latent variables; Kline, 2011), and the follow-up post-hoc power was promising as well. Thus, we believe that our model was acceptable for the purpose of our study. Next, we were limited by only considering university leadership as a source of extrinsic motivation. For many educators, the *students* are the most salient stakeholders, and teaching intentions and behaviors are more likely to be driven by student learning. Furthermore, our findings are based on instructors from a single discipline and within the Norwegian higher education context, which may limit generalizability to other fields or educational systems. Cultural, structural, and institutional differences in teaching practices elsewhere could influence the relationships observed, and replication in other disciplines and countries is recommended to assess the broader applicability of these results. In addition, two of our measures, Teaching Intentions ($\alpha = .67$) and Autonomy-Supportive Teaching Behaviors ($\alpha = .66$), demonstrated somewhat lower internal consistency than ideal. Although these values are acceptable for exploratory work and commonly observed in educational and psychological contexts with few items, they nevertheless indicate higher levels of measurement error. Lower reliability may attenuate observed associations, reduce the precision of parameter estimates, and potentially bias the structural relationships in the SEM model, typically toward underestimation. As a result, the true effects may be somewhat stronger than those reported, and any non-significant findings involving these constructs

should be interpreted with caution. Future studies should consider refining or expanding the item sets to improve reliability and ensure more robust measurement.

Next, we only assessed intrinsic motivation and external regulation in our study. It would have been interesting, and in line with SDT, to measure the rest of the motivational continuum (i.e. introjected-, identified-, integrated regulation). We recommend future studies to measure all regulations as there could be different dynamics and pathways from each regulation to the outcome variables.

Although SDT identifies autonomy, competence, and relatedness as three basic psychological needs, only autonomy support and competence were included in the present analysis. This decision reflects both theoretical and measurement considerations. First, the bioCEED survey was designed as a broad mapping tool covering a wide range of issues in biology education (e.g. teaching practices, workload, professional development, instructional preferences), and only selected SDT constructs were measured with sufficient conceptual clarity and scale reliability for analytic use. Second, autonomy support from leadership and instructors' perceived competence were most directly aligned with our research questions concerning motivational regulation and teaching behavior. In contrast, the survey's items related to collegial interactions and sense of community were not developed as validated indicators of relatedness as defined in SDT and therefore did not meet the criteria for inclusion as a theoretically coherent construct. We therefore focused on the SDT components that were both a) appropriately measured in the survey and b) directly relevant to the hypothesized motivational pathways. This analytic focus ensures a parsimonious model that remains theoretically grounded in SDT while making full use of the constructs that were reliably assessed in the survey. Items concerning collegial interactions were not designed as validated indicators of relatedness in the SDT sense. Future studies should incorporate dedicated and psychometrically robust relatedness measures to examine their role in instructors' motivational regulation and teaching practices.

Conclusion and implications

In conclusion, this study contributes valuable insights into the complex dynamics of motivation in higher education instructors. The findings reveal that competence plays a critical role in fostering intrinsic motivation, which subsequently drives teaching intentions. The absence of a significant relationship between perceived autonomy support and intrinsic motivation suggests that autonomy support alone may not be sufficient to enhance motivation in the context of higher education instructors. Instead, the relationship between autonomy support and intrinsic motivation may be mediated by other factors, such as faculty perceptions of competence, meaningful connections to their disciplines, and alignment between personal values and professional practices. A key implication of these findings is that university administrators should invest in activities that develop competence in higher education instructors; workshops, courses, intensive training series, etc. Combining these activities with an opportunity for metacognitive reflection can allow participants to assess their own growing competence, build their own autonomous motivation, and teach in ways that support student learning and motivation.

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All authors contributed to the study conception and design. The first draft of the manuscript was written by Marius Ole Johansen, and all authors commented on previous versions of the manuscript. Data collection was performed by Lucas Matias Jeno. Analyses were performed by Marius Ole Johansen, Lucas Matias Jeno, and Sehoya Harris Cotner. All authors read and approved the final manuscript.

Ethics statement

The study received formal ethical approval from the Norwegian Centre for Research Data (NSD).

Authors' contributions

CRediT: **Marius O. Johansen**: Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing; **Lucas M. Jeno**: Conceptualization, Data curation, Formal analysis, Methodology, Writing – review & editing; **Sehoya H. Cotner**: Conceptualization, Writing – review & editing.

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ORCID

Marius O. Johansen http://orcid.org/0000-0002-4289-9048
Lucas M. Jeno http://orcid.org/0000-0003-3160-9313

Data availability statement

The complete R code for the analysis is available in the repository https://github.com/MariusJohans/s_05, the raw data will be provided upon request with the corresponding author.

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