Studies in Educational Evaluation 81 (2024) 101349

Contents lists available at ScienceDirect

Studies in Educational Evaluation

journal homepage: www.elsevier.com/locate/stueduc

Dynamics of change of academics' teaching approaches: A latent profile transition analysis

Marian D. Ilie [a,b,*,1], Peter Van Petegem [c,2], Velibor Mladenovici [a,b,3], Laurenţiu P. Maricuţoiu [a,d,4]

[a] Center for Academic Development, West University of Timişoara, Romania
[b] Department of Teacher Training, West University of Timişoara, Romania
[c] Department of Training and Education Sciences, University of Antwerp, Belgium
[d] Department of Psychology, West University of Timişoara, Romania

ARTICLE INFO

Keywords:
Approach to teaching
Learning-focused
Content-focused
Latent profile transition analysis
Higher education

ABSTRACT

Current studies highlighted a positive relationship between academics' learning-focused approaches to teaching and students' active and deep learning. Thus, scholars have an ongoing debate about the dynamics of change from academics' content-focused to learning-focused approaches to teaching. Previous studies investigating this subject used variable-centered analyses (on cross-sectional or pre-post data) or person-centered analyses only on cross-sectional data. Such research approaches presented limited information about the dynamics of change in teaching approaches of naturally occurring subgroups of academics with multiple teaching approach characteristics. This study analyzed the issue using longitudinal data collected on three moments (N = 111 Romanian academics) and a person-centered approach (i.e., latent profile transition analysis). We identified three dissonant approaches to teaching and one learning-focused. Our results suggested that the process of change in approaches to teaching seems to be slow and, sometimes, discontinuous. The transition from the most dissonant approach to the learning-focused approach could occur directly or by intermediary steps described as less dissonant. These dynamics of change are similar across various subsamples defined by the academics' teaching context, specialization, gender, teaching experience, and pedagogical training programs followed. We advanced several implications for designing pedagogical programs for academics and future research.

1. Introduction

Compelling evidence highlighted the influence of academics' approaches to teaching (ATAs) on how students approached their learning. The concept of ATA was defined as a combination of intentions and strategies for teaching (Trigwell and Prosser, 1996). University teachers tend to have typical intentions and use teaching strategies in accordance with these intentions (Trigwell and Prosser, 1996). A key finding of the research focused on the ATAs is the distinction between *content-focused* and *learning-focused* ATAs (Prosser and Trigwell, 1999). The *content-focused approach to teaching* (CFAT) involves the transmission of information to students, considering students as passive recipients. In the case of the *learning-focused approach to teaching* (LFAT), the teachers' main intention is to facilitate the students' learning process. When university teachers adopt an LFAT, their students tend to use a deep approach to learning (i.e., learning focused on understanding the subject matter) (Trigwell, Prosser, & Waterhouse, 1999). Also, when academics use a CFAT, their students tend to use superficial learning strategies such

Abbreviations: Ats, approaches to teaching; ATAs, academics' approaches to teaching; CFAT, content-focused approach to teaching; LFAT, learning-focused approach to teaching.

* Correspondence to: West University of Timişoara, Department of Teacher Training, Center for Academic Development, No. 4 Vasile Pârvan Blvd., Timişoara 300223, Romania.
E-mail address: marian.ilie@e-uvt.ro (M.D. Ilie).
[1] https://orcid.org/0000-0003-4807-5258
[2] https://orcid.org/0000-0002-4078-7800
[3] https://orcid.org/0000-0002-6118-7046
[4] https://orcid.org/0000-0001-8358-3130

https://doi.org/10.1016/j.stueduc.2024.101349
Received 12 November 2023; Received in revised form 22 February 2024; Accepted 5 March 2024
Available online 27 March 2024

as memorizing the subject matter without trying to understand it (i.e., adopting a surface approach to learning) (Uiboleht, Karm, & Postareff, 2018). Moreover, Prosser, Ramsden, Trigwell, and Martin (2003) showed that when academics used an LFAT, their students tended to have better learning outcomes in comparison with situations when the academics used dissonant approaches to teaching. Dissonant ATs describe teaching that included elements derived from both main approaches (LFAT and CFAT) (Postareff, Katajavuori, Lindblom-Ylänne, & Trigwell, 2008). For example, academics intend to stimulate the students' conceptual changes about the subject using the transmission of information as the only teaching strategy. Consequently, one of the main aims of many pedagogical programs dedicated to academics is to change ATAs from CFAT to LFAT (Hicks, Smigiel, Wilson, & Luzeckyj, 2010). Thus, conducting studies on the dynamics of change in ATAs could be informative for developing effective pedagogical training programs aiming to sustain academics to teach using an LFAT. For example, knowing which intermediary steps (if any) occur in changing ATs from a CFAT to an LFAT, academic developers could tailor the pedagogical training to address each step. Such initiatives could focus on the academics' zone of proximal development and, consequently, could sustain the development of their ATs to a more LFAT. Previous studies (e.g., Antoniou, 2013; Creemers & Kyriakides, 2013) showed that such pedagogical programs that consider participants' professional development level (of approaches to teaching in our case) and their specific professional needs could be more effective than training initiatives with a holistic instructional design. Thus, as a recent meta-analysis (Ilie et al., 2020) of controlled studies reported a small practical effect of pedagogical programs on academics' outcomes ($d = 0.315$). Therefore, developing pedagogical programs for academics in accordance with their ATs profiles could represent a more effective academic development practice in comparison with current training initiatives aimed to develop ATAs toward LFAT.

This study investigates the existence of transitive stages in the change from CFAT to LFAT. For the first time in the field, we used latent profile transition analysis (LPTA, Hickendorff, Edelsbrunner, McMullen, Schneider, & Trezise, 2018) to uncover the academics' profiles based on their ATs, examine the profiles' stability, and assess whether individuals transition from one profile to another at distinct time points. While previous studies explored the topic as a general pattern in the academic population, LPTA allows us to identify dynamics of change in ATAs of naturally occurring subgroups of academics. Based on our results we advanced several implications for designing pedagogical programs for academics and future research.

1.1. Investigating dynamics of change of academics' approaches to teaching

The dynamics of change from CFAT to LFAT is an ongoing debate. Prosser and Trigwell (2006) presented the two approaches as opposite variables having a significant negative correlation. Thus, the desirable change could take place directly from one to another approach. Meyer and Eley (2006) described the two approaches as opposite poles on a continuum. In this vein, the change from a content-focused to a learning-focused academic' profile should occur through one or more intermediary steps. However, Stes and Van Petegem (2014) identified two consonant and two dissonant ATs and concluded that the main ATs (CFAT and LFAT) are separate categories but also could be seen as poles of a continuum.

There are two different research traditions in studies investigating ATAs. First, most studies used a group-centered analysis based on cross-sectional or longitudinal data (e.g., Emery, Maher, & Ebert-May, 2020; McMinn, Dickson, & Areepattamannil, 2020). These studies described ATs at a group level and overlooked individual differences. Second, some studies (Cao, Postareff, Lindblom-Ylänne, & Toom, 2019; Cao, Postareff, Lindblom-Ylänne, & Toom, 2021; Stes & Van Petegem, 2014) used a person-centered analysis but only on cross-sectional data. These studies presented essential findings on the characteristics of ATs at the person-level but provided only weak indications about the change of ATs over time. As ATs are a personal characteristic and their transition to more LFAT is a central aim of the researchers in the field, studies that use person-centered analysis and longitudinal data seem paramount for advancing our knowledge on the subject (Cassidy & Ahmad, 2019; Stes & Van Petegem, 2014). To analyze the longitudinal ATAs data from a person-centered perspective, we could use several statistical techniques, but LPTA seems to be the most adequate (Morin & Litalien, 2017).

LPTA integrates auto-regressive modeling (i.e., a variable that predicts itself in the future) (Nylund, Muthén, Nishina, Bellmore, & Graham, 2006) to examine group membership throughout time and an extensive set of model constraints. Furthermore, LPTA investigates at the same time the profile membership, profile stability, and the relations between the antecedents and outcomes, and profiles. For example, using LPTA, one could estimate ATAs profiles at the enrollment moment in one pedagogical training program and six and twelve months after the end of the training programs. Also, LPTA could highlight academics' movement between these groups, estimating the probability of group memberships and transitions. Thus, LPTA informs us about academics' probability of following various transition trajectories, from one teaching approach to another approach over time.

One could use LPTA to investigate whether the ATAs profiles are associated with contextual factors and with academics' characteristics (e.g., teaching context, gender, teaching experience, specialization). Such an approach could be very useful as several variables seem to have a role in influencing academics' preference for a particular AT (Stes, Donche, & Van Petegem, 2014). Academics tend to have stronger learning-focused intentions in a less-known teaching context (e.g., if they must teach a new discipline) and are more content-focused on a known teaching context (Lindblom-Ylänne, Trigwell, Nevgi, & Ashwin, 2006). Also, when the class size and students' academic year increase, academics seem to be more predisposed to adopt a CFAT (Singer, 1996). Female teachers seemed to be more learning-focused, while male teachers were more content-focused (McMinn et al., 2020). Several studies (e.g., Lindblom-Ylänne et al., 2006; McMinn et al., 2020) concluded that academics from "soft disciplines" (e.g., linguistics or education) are more learning-focused on their AT than academics belonging to "hard disciplines" (e.g., mathematics or medicine). Postareff, Lindblom-Ylänne, and Nevgi (2007) concluded that academics with more than 13 years of teaching experience scored highest on the CFAT, and those with less than two years of experience scored lowest. At the same time, some studies reported insignificant differences in academics' ATs when considering the variables mentioned above (i.e., study years, class sizes, specialization – Stes, Gijbels, & Van Petegem, 2008; gender – Emery et al., 2020; teaching experience or status – McMinn et al., 2020).

1.2. Approaches to teaching as an outcome of pedagogical training programs

The pedagogical training programs for academics first developed in the 1950 s in the USA, and now this practice is an ongoing activity of most universities (Hodgson & Wilkerson, 2014). All over the world, many universities have set up different institutional structures (centers or units) to provide pedagogical training programs for academics (Jacob, Xiong, & Ye, 2015). Moreover, universities from many countries (e.g., UK, Sweden, or the Netherlands) have decided regarding the compulsory nature of the pedagogical training of academics (e.g., Sonesson & Lindberg Sand, 2006). In this context of pedagogical training programs dedicated to university teachers, changing academics' approaches to teaching from content-focused to learning-focused is one of the main aims of the training programs (Hicks et al., 2010). Consequently, many research studies that presented training programs for academics investigated the effect of pedagogical training on approaches to teaching as defined in the present paper (Ilie

et al., 2020).

Several studies presented evidence regarding the successful change of ATAs from a CFAT to a LFAT following a training program. For example, Gibbs and Coffey's study (2004) involved participants in pedagogical training (ranging in duration from 60 to 300 h) from 22 universities and eight countries. Compared to the control group, the training group significantly increased their LFAT. Emery et al. (2020) investigated the effect (over 6 and 9 years) of a 2-years long USA national-level program dedicated to biology postdoctoral scholars (i.e., The Faculty Institutes for Reforming Science Teaching - FIRST - IV program). The results showed that the effect of the program persisted over time as the participants reported a more LFAT and less CFAT compared with their colleagues. In another study, Taylor and Znajda (2014) used a small sample (representing a large spectrum of disciplines) and a mixed research design to investigate the effect of a six-month program. The participants reported a shift towards a LFAT after the pedagogical program. However, a recent meta-analysis (Ilie et al., 2020) of controlled studies showed a small practical effect of pedagogical programs on academics' outcomes (d = 0.315).

The studies mentioned above, as well as most research investigating the effect of pedagogical programs for academics, searched for evidence about increasing the participants' scores on the LFAT and decreasing scores on the CFAT as two separate purposes. Even though researchers also used classroom observations (Emery et al., 2020) or participants' interviews (Taylor & Znajda, 2014) complementary to self-reported ATs, the main aim of the investigation remained the same (i.e., evidence about increasing or decreasing scores on ATs). From a practical point of view, such an investigative approach seems to advance limited information for improving the quality of pedagogical programs dedicated to academics. Pedagogical training programs could promote the change of ATAs to a more LFAT, but we know very little about how this change occurs. Recently, Cassidy and Ahmad (2019) aimed to explore the change mechanisms of the ATs. The two authors collected data through the *Approaches to Teaching Inventory-Revised* (ATI-R; Trigwell, Prosser, & Ginns, 2005), and investigated the effect of a 25-hours pedagogical program. The authors pointed mainly to observed latent structural changes of ATs rather than variations of score values. Their main result showed that participants' ATs changed from a dissonant approach towards two different consonant approaches (LFAT or CFAT) based on their enhanced capacity to distinguish between the two approaches. The authors concluded that pedagogical initiatives aimed to stimulate academics' teaching towards a more LFAT should be tailored to help participants to distinguish the two main approaches more effectively. In the limitation section, Cassidy, and Ahmad (2019) suggested that studies investigating these changes in ATs at the individual level could be an important avenue to advance the knowledge on the topic. In this study, we considered their suggestion and aimed to analyze the changes of ATAs at a more individual level or person-oriented by using latent profile transition analysis and data collected from academics enrolled in pedagogical programs over three moments in time (i.e., before the programs and six and twelve months after the training).

2. The current study

This study aimed to test the existence of transitive stages in the change from the CFAT to the LFAT. We used the LPTA and assessed the optimal number of profiles, the temporal stability of different academics' profiles, profile membership, and academics' transition between different ATs along three moments of the investigation process. Also, we examined the relations between academics' profiles and contextual and demographic variables (i.e., teaching context, participants' gender, discipline, teaching experience, academic status, and training programs followed).

3. Method

3.1. Participants and procedure

Initially, an open call was sent out to all university teachers from five Romanian universities, inviting them to participate voluntarily in one of the three pedagogical training programs implemented by the teaching center of a Romanian university. Thus, between July 2018 and July 2021, 250 academics were enrolled in three 15 ECTS pedagogical training programs. The primary purpose of these programs was to change the academics' teaching towards LFAT. All the enrolled academics were asked to complete online the Romanian version (Mladenovici, Ilie, Maricuțoiu, & Iancu, 2021) of the R-ATI (Trigwell et al., 2005) in three distinct moments (i.e., before the programs – T1, six months after the program– T2, and twelve months after the program– T3). Academics were invited to present their ATs at a discipline they had been teaching at the T1 and consider the same discipline (if possible) for further assessments. As participation in the training and the research study was voluntary, in accordance with the World Medical Association Helsinki Declaration, no ethical board approval was required for the present study.

Our sample consisted of 111 academics (65.8% female, mean age = 44.23) from five Romanian universities who responded in all three data collection moments (Table S1, Supplementary Material). Because only a part of the academics who participated in the training programs provided useful data for the present study (i.e., 111 out of 250), we investigated possible sampling bias due to the participant loss. In this vein, we compared data collected in T1 from university teachers who participated in all the waves with all data collected in T1. Thus, we performed independent t-tests and chi-square analysis to compare our samples on different characteristics (i.e., gender and age, class size, teaching responsibilities, teaching experience, and academic status) and on the five dimensions of the R-ATI (Stes, De Maeyer, & Van Petegem, 2010). The analyses highlighted no significant differences; therefore, the sampling bias was unlikely to occur.

3.2. Measure

We used the 5-factors R-ATI (Trigwell et al., 2005) version as validated by Stes *et al.* (2010) to gain higher variability in academics' teaching profiles. In this coding version, the R-ATI 22 items were grouped into five factors that are summed under two components: "Student-centred approach aimed at conceptual change" (i.e., *conceptual change*, *discussion teacher–students*, and *discussion among students*) and "Teacher-centred approach aimed at information transmission" (i.e., *information transmission* and *test focus)*. For each item, the responders completed a 5-point Likert scale (1 = *never/only rarely true of me* to 5 = *always/almost always true of me*).

3.3. Data analysis

Before conducting the main analyses (i.e., LPA and LPTA), we assessed the 5-factors R-ATI version (Stes et al., 2010) on the Romanian academic population. We presented the preliminary data analysis details in the Online Supplementary Material.

The latent analyses were carried out with Mplus Version 8.5 (Muthén & Muthén, 1998-2017) using the MLR (i.e., maximum likelihood robust estimator). The MLR delivers standard errors robust to violations of the assumption of normality that frequently arises when working with ordinal measures (i.e., as the measures used in the present study). As all the 111 academics answered in the three-time points, there was no need for missing data estimators in the longitudinal models. In estimating the LPA models, all LPA were performed with 3000 random sets of start values and 100 iterations to avoid local maximum. For the final stage optimization (Morin, Gallagher, Meyer, Litalien, & Clark, 2021), the 100 best solutions were retained. In the case of the longitudinal models,

those values were increased to 10,000, 1000, and 500.

Regarding the main data analysis, we used the recommended steps of the most optimized version of the LPTAs (Morin, Meyer, Creusier, & Biétry, 2016, 2021; Morin & Litalien, 2017). First, we used the five factors of the R-ATI for each time point to check if the same number of profiles would be extracted by estimating LPA models. We checked solutions with one to six profiles for each time point. In all estimated profiles, the means and variances of the academics' teaching approaches factors were freely estimated (Peugh & Fan, 2013). As both theoretical reasoning and statistical adequacy solutions should be taken into account to decide the optimal number of profiles in the data (Marsh, Lüdtke, Trautwein, & Morin, 2009; Muthén, 2003), several statistical indicators were considered (Nylund, Asparouhov, & Muthén, 2007): Bayesian information criterion (BIC), Akaïke information criterion (AIC), the consistent AIC (CAIC), sample-size adjusted Bayesian information criterion (SABIC), the bootstrap likelihood ratio test (BLRT), and the adjusted Lo, Mendel and Rubin's likelihood ratio test (Lo, Mendell, & Rubin, 2001). The solution with the lower AIC, BIC, CAIC, and SABIC was preferred for better model fit. In the cases of the BLRT and aLMR, a significant p-value means that an additional profile (k) contributes to the solution (i.e., the current model is significantly better than the previous model with k-1 profiles). Especially when the sample size is not too large (Marsh et al., 2009), simulation studies demonstrated that CAIC, BIC, SABIC, and BLRT are particularly effective (Nylund et al., 2007; Peugh & Fan, 2013). Opposingly, studies showed that AIC and LMR/aLMR should be used cautiously in the profile enumeration as they tend either to under-extract or over-extract incorrect number of profiles (Nylund et al., 2007; Peugh & Fan, 2013). As a control measure, information criteria (i.e., AIC, CAIC, BIC, and SABIC) should be graphically represented through "elbow plots" (Morin et al., 2011). According to Morin et al. (2011), the optimal number of profiles is illustrated by the point (or moment) after the slope flattens out.

Second, once the optimal number of profiles that provide the best fit to the data has been selected for each time point, a longitudinal model was conducted (i.e., by combining the three time-specific solutions) (Morin et al., 2016; Morin & Litalien, 2017). Thus, we assessed the extent to which latent profile solutions can be generalized to different subsamples of academics according to a sequence of profile similarity tests. Specifically, we checked the following aspects: (a) the exact number of profiles based on the same indicators (i.e., configural similarity); (b) the same within-profile means (i.e., structural similarity); (c) the same within-profile variances in all-time points (i.e., c1 - dispersion similarity) and equal within-profile variance across most time points and one freely estimated time point (i.e., c2 - partial dispersion similarity); (d) the same marginal probabilities, or relative size of the profiles (distributional similarity). Further, we compared the fit indices of these models (i.e., a, b, c1, c2, d) using at least two out of the BIC, ABIC, and CAIC as suggested by Morin et al. (2016), with lower values suggesting a better model fit.

Third, after we estimated the five models described in phase 2, the most similar model was retained for further analysis. Hence, to examine change in profile membership and within-person stability, the most similar model resulting in the 2nd phase was converted into an LPTA model (or a longitudinal LTA) (i.e., by adding time-specific predictions) (Morin & Litalien, 2017). Precisely, in our LPTA model, the profiles estimated at Time 3 (c3) were predicted by the profiles estimated at Time 2 (c2), while the profiles estimated at Time 2 (c2) were predicted by the profiles estimated at Time 1 (c1).

In the fourth phase, we assessed the relations between a series of demographic controls as predictors and the probability of profile membership. Precisely, after we assessed the necessity to include demographic controls as predictors of the profiles to the LPTA model (Morin et al., 2016), we estimated and contrasted four alternative models. In the first model (4.1.) (i.e., a null effect model), the relations between profiles and demographics were constrained to be zero. In the second model (4.2.), the relations between the profiles and the demographics across time points were freely estimated, and predictions of the profiles estimated at T2 and T3 were permitted to vary over the T1, respectively T2 (i.e., profiles estimated at the previous moment). Therefore, in the second model, we performed a straightforward examination of the effect of the demographics on the profile transitions. In the third model (4.3.), the effect of the demographic's controls was not allowed to predict the transitions between profiles, it was only allowed to change over time (i.e., predictions were not freely estimated across profiles, but they were freely estimated across the three time points). In the fourth model (4.4.), the models' predictive similarity was assessed by constraining the predictions to equality across the time points. Next, the relations between the prior predictor and the likelihood of profile membership were estimated using the same strategy.

4. Results

The estimated fit indices of the LPA for each of the three-time points are reported in Table S4 (Supplementary Material). The results indicated that the AIC and SABIC indices kept decreasing in all three-time points (T1, T2, and T3) with the addition of profiles. The CAIC followed the same trend as AIC and SABIC in the T1 and T2, except for the T3, in which it reached its lowest point at four profiles. The BIC suggested the four-profile solution as optimal at all three-time points. Also, both the aLMR and BLRT suggested four profiles at the T2 and T3, while at the T1, aLMR suggested three profiles and BLRT five profiles. The entropy index's values were relatively high (0.88–0.94) and similar across models and time points (i.e., the only exception being a 2-profile solution with entropy scores of.78 in T1 and 1.00 in T2 and T3). Complementary, we considered the elbow plots reported in Figs. 1, 2 and 3. The relative fit improvement linked with the addition of latent profiles reached a plateau of around four profiles. After examining several LPA solutions (e.g., with three, four, and five profiles), the four-profile solution was chosen as optimal.

We estimated a three-wave longitudinal LPA model of configural similarity considering 4-profiles per time point. Next, to estimate the structural similarity of the longitudinal LPA model, the within-profile means on the five ATs factors were constrained to be similar across time points. Due to a zero estimated variance (i.e., no within-class variation for the variables DTS2 and DTS3, which had the maximum mean score = 5.00), the structural similarity model was considered non-optimal. Therefore, we further contrasted the model of configural similarity (i.e., the initial model) and the model of dispersion similarity (i.e., the third model). The dispersion similarity model conveyed higher values on all the information criteria than the structural similarity model. Hence, the dispersion similarity of the profiles was not supported. After examining the earlier models' parameter estimations, a reduced level was observed at T2 in the case of within-profile variability. Accordingly, a model of partial dispersion similarity was further estimated. In the newly estimated model, while at the T1 and T3 time points, the within-profile variability levels were constrained to equality, across the T2, those were freely estimated. Compared to the model of configural similarity, the partial dispersion similarity models' solution was supported (i.e., the BIC, ABIC, CAIC, and SABIC indices reported lower values). Ultimately, we calculated a distributional similarity model. In contrast to the partial dispersion similarity model previously estimated, the values of all information criteria increased (i.e., meaning that the profiles' sizes differ across time points). Hence, after examining the results, we concluded that there was no meaningful distributional similarity solution. Consequently, for the following stages of analysis, the partial dispersion similarity model was retained and transformed into a complete LPTA model. The descriptive statistics of the final LPTA model are presented in Table S5 (Supplementary Material). This last LPTA has a rather elevated level of classification accuracy (i.e., the model has an entropy of.90). The statistical indicators of the LPTA model are presented in Table 1. Additionally, the relative size of the profiles and the transition likelihoods across the T1, T2, and T3 time

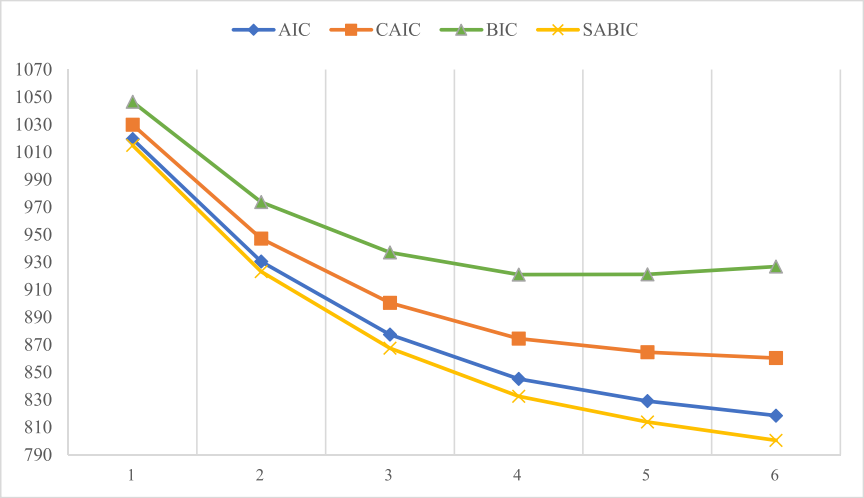

Fig. 1. *Elbow plot of the information criteria of the latent profile solutions* at *Time 1*. **Note.** The values of estimated fit indices AIC **AIC** = Akaïke information criteria, CAIC. **CAIC** = Consistent AIC, BIC **BIC** = Bayesian information criteria, and SABIC **SABIC** = sample size adjusted BIC at Time 1 are presented on the vertical axis. The number of profiles (i.e., LPA solutions) is illustrated on the horizontal axis. The optimal solution is represented by the point (or moment) after the slope flattens.

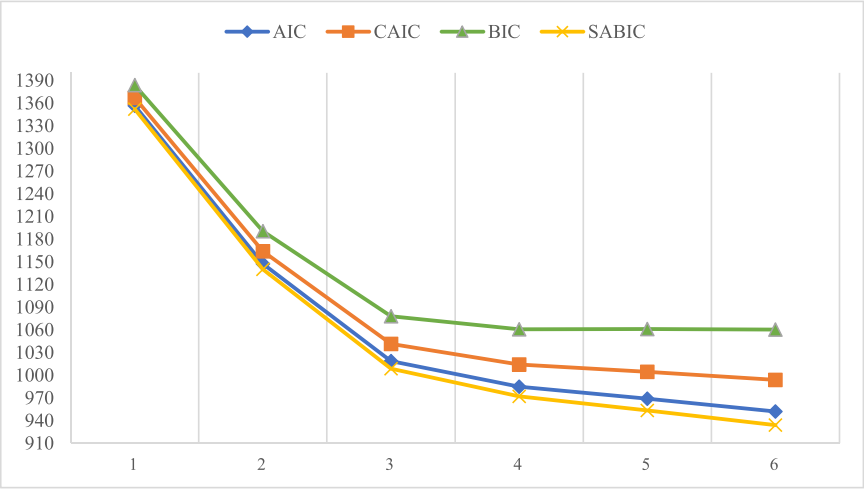

Fig. 2. *Elbow plot of the information criteria of the latent profile solutions* at *Time 2*. **Note.** The values of estimated fit indices AIC **AIC** = Akaïke information criteria, CAIC **CAIC** = Consistent AIC, BIC **BIC** = Bayesian information criteria, and SABIC **SABIC** = sample size adjusted BIC at Time 2 are presented on the vertical axis. The number of profiles (i.e., LPA solutions) is illustrated on the horizontal axis. The optimal solution is represented by the point (or moment) after the slope flattens.

points are reported in Table 2. Also, a graphical representation of the LPTA model is presented in Fig. 4.

Based on specific dimensions of academics' ATs, investigation of LPTA profiles indicates noticeable qualitative differences. To decide the quality of the profiles, we classified the scores of each dimension as "high", "moderate," or "low". As Stes and Van Petegem (2014) did before, these qualifications were attributed based on the scale average and considering each score in relation to the mean of the other profiles. We intended to label as dissonant profiles which reported similar qualifications for dimensions included in both main orientations (learning- and content-focused). Also, we planned to consider as consonant (learning- or content-focused) the profiles with different qualifications in each of the two main orientations. Profiles 1, 3, and 4 resulted as dissonant, and Profile 2 was a consonant learning-focused approach (Table 3).

Profile 1 - *Learning-focused but still dissonant* profile included academics with high or moderate intentions of changing students' conceptions and moderate intentions of transmitting the information. This profile is also characterized by high or moderate use of strategies from both content and learning approaches. Profile 1 describes a high expansion in the proportion of academics over time, increasing from T1 with 39.64% (N = 44) of the total sample to 41.44% (N = 46) at T2 and 51.35% (N = 57) at T3 time point. This increase seems to be mainly linked to academics' tendency to transition from other profiles to the following time point (i.e., Profile 2, 3, and 4 from T1 to T2 and Profile 2 and 4 from T2 to T3). Profile 1 remains relatively stable over time, with 65.2% profile stability between T1 and T2 and 82.7% between T2 and T3.

Profile 2 - *Leaning-focused developing profile* is characterized by high scores on intentions and strategies associated with LFAT and moderate or low scores on strategies and intentions related to CFAT. Because the scores on the two content-focused dimensions are below the scale average, Profile 2 was named a developing one and not a full consonant learning-focused profile. Profile 2 has a moderately stable membership over time (i.e., 63.3% from T1 to T2 and 64.7% from T2 to T3). Also, there was an increase in the academics' percentage in Profile 2 over the three-time points. At T1, the academics likelihood of being in Profile 2

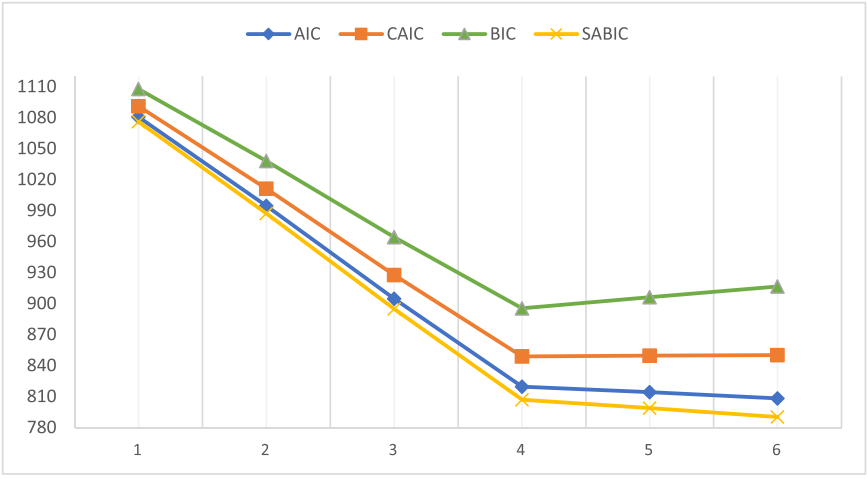

Fig. 3. *Elbow plot of the information criteria of the latent profile solutions* at *Time 3.* **Note.** The values of estimated fit indices AIC **AIC** = Akaïke information criteria, CAIC **CAIC** = Consistent AIC, BIC **BIC** = Bayesian information criteria, and SABIC **SABIC** = sample size adjusted BIC at Time 3 are presented on the vertical axis. The number of profiles (i.e., LPA solutions) is illustrated on the horizontal axis. The optimal solution is represented by the point (or moment) after the slope flattens.

Table 1
Results from the latent profile transition analyses estimated on the full sample.

Model	LL	#fp	Scaling	AIC	CAIC	BIC	SABIC	Entropy
Final Latent Profile Analysis								
Time 1 (N = 111) – 4 profiles	–394.534	28	1.373	845.069	874.337	920.936	832.450	.88
Time 2 (N = 111) – 4 profiles	–464.342	28	1.376	984.684	1013.953	1060.550	972.065	.92
Time 3 (N = 111) – 4 profiles	–381.776	28	1.069	819.552	848.821	895.419	806.934	.94
Longitudinal Latent Profile Analysis								
Configural Similarity	–1185.010	129	1.158	2628.021	2762.867	2977.550	2569.885	.89
Structural Similarity	-	-	-	-	-	-	-	-
Dispersion Similarity	–1359.333	49	1.570	2816.665	2867.887	2949.432	2794.583	.90
Partial Dispersion Similarity	–1232.589	69	1.054	2603.177	2675.305	2790.135	2572.081	.86
Distributional Similarity	–1259.242	63	1.277	2644.484	2710.339	2815.185	2616.092	.83
Latent Profile Transition Analysis (Partial Dispersion)	**–1173.297**	**87**	**1.240**	**2520.594**	**2611.537**	**2756.323**	**2481.386**	**.90**
Predictive Similarity (Demographic Controls)								
Null Effects Model	–1173.297	87	1.2398	2520.594	2611.537	2756.323	2481.386	.89
Profile-Specific Free Relations with Predictors	-1044.642	285	0.5564	2659.283	2957.201	3431.500	2530.844	.97
Free Relations with Predictors	–1094.219	141	1.0513	2470.438	2617.829	2852.482	2406.894	.95
Similar Relations with Predictors	–1157.981	102	1.0101	2519.961	2626.585	2796.333	2473.993	.94

Note. LL = model loglikelihood; #fp = number of free parameters; scaling = scaling correction factor associated with robust maximum likelihood estimates; AIC = Akaïke information criteria; CAIC = Consistent AIC; BIC = Bayesian information criteria; SABIC = sample size adjusted BIC.

was 19.82% (N = 22). This percentage increased to 25.23% at T2 and 28.83% (N = 32) at T3. This increase is linked to academics' tendency to transition from Profiles 1, 3, and 4 from T1 to T2 and Profile 1 and 4 from T2 to T3.

Profile 3 - *Dissonant vague defined profile* included academics with small scores on all subscales. Thus, these academics did not prefer one or another of the two approaches. As the sample size of Profile 3 is pretty small, interpreting the changes in this profile should be done very carefully. However, membership in Profile 3 appears to be the most unstable over time (with 38.3% from T1 to T2 and 57.3% from T2 to T3). This profile describes a slight increase from T1 (N = 8) to T2 (N = 9) and a decrease between T2 and T3, from 9 academics (8.11%) to 5 (4.51%).

Profile 4 - Dissonant clearly defined profile had high scores on all subscales. This Profile is similar to Profile 3 because academics expressed similar preferences toward both approaches. Unlike Profile 3, Profile 4 is more dissonant, having high levels on all subscales of both approaches. Profile 4 is characterized by a moderately stable membership across the three-time points (i.e., 61.9% stability from T1 to T2 and 60% from T2 to T3). This profile presented a significant decrease from 33.33% (N = 37) of the sample at T1 to 25.23% (N = 28) at T2 and to 15.32% (N = 17) at T3. The academics that do not remain in Profile 4 overtime transition either to Profile 1 (i.e., 18.4% from T1 to T2 and 25.4% from T2 to T3) or to Profile 2 (i.e., 17.1% from T1 to T2 and 14.6% from T2 to T3).

Finally, demographic control variables were added to the LPTA model of partial dispersion similarity. After comparing all the estimated alternative models, the first model (i.e., a null effect model) had the lowest values on two out of the four information criteria (i.e., CAIC and BIC). The null effect model's two other information criteria (i.e., AIC and SABIC) were slightly higher than the third model (i.e., Free Relations with Predictors Model). Nevertheless, according to the third model's specification, the demographic variables cannot predict the profile transitions (i.e., the demographic controls are only allowed to change over time). Therefore, we did not find significant associations between the demographic variables and the transition of the ATA profiles. This conclusion is also supported by the detailed parameters estimate of the other alternative models and the low correlations between all R-ATI five factors and demographic variables (Table S6, Supplementary Material).

5. Discussion

We investigated the changes in ATAs and found three dissonant ATs and one quite consonant LFAT that could represent four stages of change from CFAT to LFAT. Interpreting the four profiles as stages of change of

Table 2
Relative size of the profiles and transitions probabilities for the latent transition analysis.

		Transition Probabilities to Time 2 Profiles			
	Relative size	Profile 1	Profile 2	Profile 3	Profile 4
Time 1 Profiles					
Profile 1	39.64% (N = 44)	0.652 (29)	0.158 (7)	0.103 (5)	0.087 (3)
Profile 2	19.82% (N = 22)	0.294 (5)	0.633 (15)	0.000	0.073 (2)
Profile 3	7.21% (N = 8)	0.617 (5)	0.000	0.383 (3)	0.000
Profile 4	33.33% (N = 37)	0.184 (7)	0.171 (6)	0.027 (1)	0.618 (23)
Relative size		41.44% (N = 46)	25.23% (N = 28)	8.11% (N = 9)	25.23% (N = 28)
		Transition Probabilities to Time 3 Profiles			
	Relative size	Profile 1	Profile 2	Profile 3	Profile 4
Time 2 Profiles					
Profile 1	41.44% (N = 46)	0.827 (38)	0.153 (7)	0.000	0.020 (1)
Profile 2	25.23% (N = 28)	0.353 (10)	0.647 (18)	0.000	0.000
Profile 3	8.11% (N = 9)	0.000	0.427 (4)	0.573 (5)	0.000
Profile 4	25.23% (N = 28)	0.254 (9)	0.146 (3)	0.000	0.600 (16)
Relative size		51.35% (N = 57)	28.83% (N = 32)	4.51% (N = 5)	15.32% (N = 17)

ATAs could have practical implications as previous studies identified specific relations between different stages of teaching approaches or skills with students' outcomes (e.g., Creemers, Kyriakides, & Antoniou, 2013; Kyriakides, Creemers, & Antoniou, 2009; Prosser et al., 2003). For example, Prosser et al. (2003) reported that academics with a clearly defined LFAT stage could have more positive effects on students' learning outcomes than university teachers who are still in a dissonant teaching approach stage. Also, in the pre-university education context, Kyriakides et al. (2009) identified five gradual stages of teachers' behavior, with each stage grouping several teaching skills. The authors also highlighted that more advanced skills defined by LFAT and differentiation of teaching have a better impact on students' outcomes.

The four profiles identified in this study have several similarities with those described in previous research. Profile 1 – *Learning-focused but still dissonant profile* is comparable with *contextually varying profiles* described by Postareff et al. (2008). Similar to the profile presented by Postareff et al. (2008), in Profile 1, academics' intentions of teaching and learning are more learning-focused than content-focused. Also, these academics seem to give the same importance to both types of teaching strategies. However, we did not find evidence for a contextual variation of the teaching strategies, as Postareff et al. (2008) suggested. At first glance, Profile 2 – *Leaning-focused developing profile* having a clear consonant learning-focused aspect is similar to Cluster C advanced by Stes and Van Petegem (2014). However, due to moderate scores reported on information transmission and test-focused sub-scales, Profile 2 seems more similar to the *developing profiles* registered by Postareff et al. (2008). Profile 3 – *Dissonant vague defined profile* is similar to Cluster – *vague approach to teaching* reported by Cao et al. (2019, 2021) on Chinese and Finnish samples. Profile 4 – *Dissonant clearly defined profile* could be interpreted as being quite similar to *systematically dissonant profiles* reported by Postareff et al. (2008). Our four profiles had different levels of dissonance. Profile 4 had high scores on all five subscales and could be interpreted as more dissonant than Profile 3, which presented small scores of all the five dimensions of approaches. Profiles 1 and 2 were clearly learning-focused oriented but also had high or moderate intentions to use content-focused teaching strategies. Profile 1 presented high or moderate scores on both teaching strategies. Profile 2 had a more evident orientation to learning-focused strategies showing relatively moderate intentions to use content-focused teaching strategies. Thus, we could position these profiles on the following continuum:

Profile 4→Profile 3→Profile 1→Profile 2.

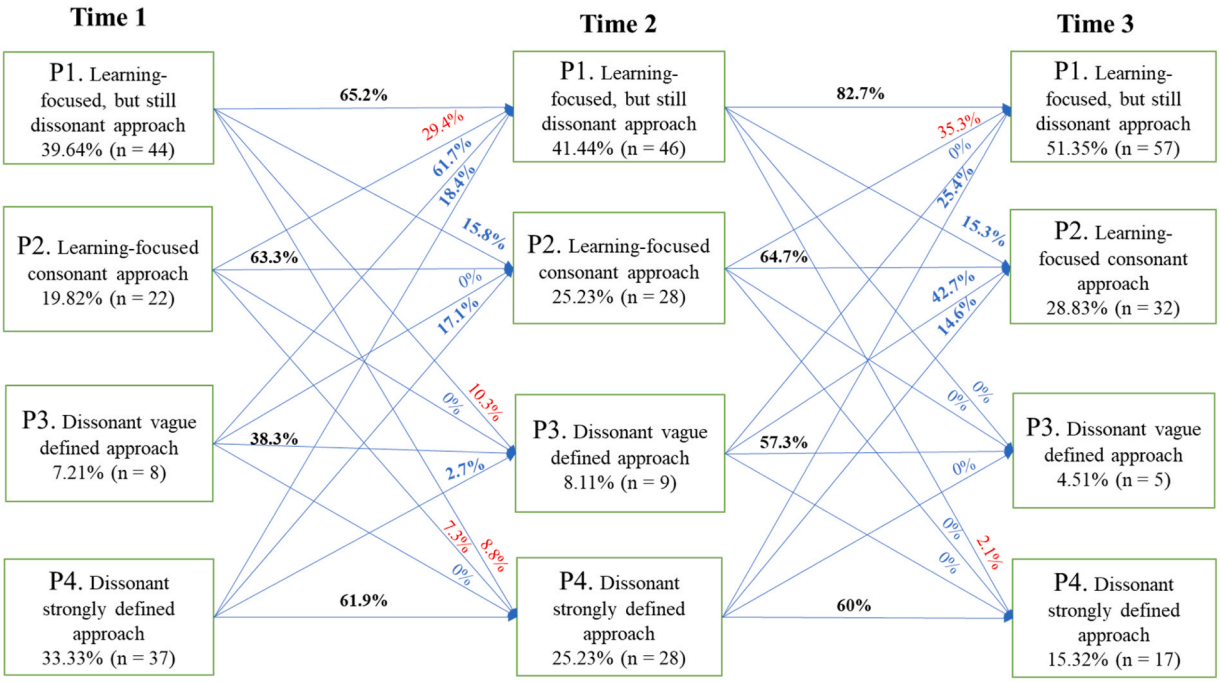

Fig. 4. Graphical Representation of the Relative Size of the Profiles and Transitions Probabilities between the Four Identified Latent Profiles of Teaching Approaches.
Note. The relative size (n = number of participants) of the profiles (P1, P2, P3, and P4) and the transition likelihoods (%, %, %) across the T1, T2, and T3 time points are presented in Fig. 4. The blue arrows (→) illustrate the direction of the transition from one profile to another. Different colours of the percentage probabilities from T1 to T2 and from T2 to T3 were used: black *(%)* represent *transitions into the same profile, blue (%) the transition from a less desirable profile to a better profile,* and red *(%) transition from a desirable profile to a less desirable profile in the subsequent time point.*

Table 3
Overview of the qualitative differences between profiles.

Profiles no.	Label	No. of academics'			Learning-focused dimensions			Content-focused dimensions	
		time 1	time 2	time 3	Conceptual change	Discussion teacher – students	Discussion among students	Information transmission	Test-focus
P1	Learning-focused, but still dissonant Profile	44	46	57	High or Moderate	High or Moderate	Moderate	Moderate	High or Moderate
P2	Leaning-focused developing Profile	22	28	32	High	High	High	Moderate or Low	Moderate or Low
P3	Dissonant vague defined Profile	8	9	5	Low	Low	Low	Low	Low
P4	Dissonant clearly defined Profile	37	28	17	High	High	High	High	High

The four profiles are mainly characterized by changes in academics' intentions to teach and less by changes in instructional strategies. Academics from Profile 3 seem to address similar importance to both intentions and strategies associated with the two main orientations (i.e., content-focused and learning-focused). Also, academics in Profile 1 seem to distinguish between intentions to change students' conceptions and intentions to transmit information but have difficulties differentiating between content-focused and learning-focused instructional strategies. Thus, our result is convergent with previous studies (Mladenovici et al., 2021; Trigwell & Prosser, 1996) which suggested that changes in academics' conceptions of teaching are prerequisites for changes in academics' instruction strategies. Complementary, there are four types of dynamics of change between our profiles, which we discussed in the following paragraphs.

First, several trajectories of changes could be indicators of the continuum of ATAs described above. For example, 2,7% of Profile 4 in T1 changed to Profile 3 in T2. Also, 61,7% of Profile 3 changed to Profile 1, and 15,8% of Profile 1 changed to Profile 2. Moreover, 9,44% of the evolution of academics with Profile 3 in T1 developed in Profile 1 (T2), and then in Profile 2 (T3). This evolution trajectory followed the steps of our theoretical description of the continuum of approaches. In previous studies, the authors advanced three types of continuums regarding ATAs (Postareff et al., 2008; Trigwell, Prosser, & Taylor, 1994; Stes & Van Petegem, 2014). These authors described one consonant content-focused profile on the left-hand start of their continuum and at least one consonant learning-focused profile on the right-hand end. Nevertheless, we identified two dissonant approaches on both extremes of our continuum. One highly dissonant profile (Profile 4) is the first step of the continuum, and one quite consonant learning-focused profile (Profile 2), but still dissonant, is the final step. Academics in our sample were enrolled in pedagogical training programs, which was not the case in earlier studies (e.g., Postareff et al., 2008). Kálmán, Tynjälä, and Skaniakos (2020) showed that academics that use a CFAT were least open to enrolling in professional development programs. This could explain why we did not identify a consonant CFAT. However, our four profiles could be intermediary steps in the continuums described by the previous studies (e.g., Stes & Van Petegem, 2014).

Second, the stability of the profiles could suggest the presence of well-stabilized ATs rather than a continuum. More than 50% of the academics presented Profile 1, and more than 40% that had Profile 2 in T1 maintained the same approach across the three moments investigated over time. Also, more than 37% of the academics that could be described based on Profile 4 and more than 21% that reported Profile 3 in the T1 maintained their profiles of approaches over time. Thus, the profiles (Profile 1 and Profile 2) described as more learning-focused are also more stable than profiles 3 and 4, which are more content-focused. Contrary to our results, Lindblom-Ylänne et al. (2006) reported that the LFAT is more sensitive to the teaching context than the CFAT. However, we investigated the influence of the teaching context on changing ATs, but we did not identify any significant results. The stability of our profiles could be explained by the length of the pedagogical programs graduated by academics. The academics included in our sample graduated with 15-ECTS programs. Postareff *et al.* (2007) showed that pedagogical programs ranging between 10 and less than 30 ECTS had the smallest impact on LFAT compared to less than 10-ECTS or more than 30-ECTS programs.

Third, some trajectories of changes have not supported the existence of the continuum of approaches mentioned above. For example, from T1 to T2, 7,4% of academics with Profile 2 and 8,8% from Profile 1 (the lowest dissonant profile) adopted Profile 4 (the most dissonant profile). These trajectories had opposite directions to those sustained by the continuums described in this study or other previous studies (e.g., Stes & Van Petegem, 2014). However, such trajectories of changes were less frequent from T2 to T3. Moreover, from T2 to T3, 25,4% of the academics in Profile 4 changed their approach to Profile 1, and 14,6% to Profile 2. Consequently, developing ATs into more learning-focused profiles seems a slow and discontinuous process. Postareff *et al.* (2007) advanced similar findings. In their study, academics reporting the smallest and the largest number of pedagogical training hours had higher scores on the LFAT than whit who declared an intermediary number of training hours.

Fourth, from T1 to T2, 17,1% of academics with Profile 4 avoided two intermediary steps (Profile 3 and Profile 1) and changed their profile to the most learning-focused (Profile 2). Also, from T2 to T3, 42,7% of academics in Profile 3 adopted directly Profile 2, skipping Profile 1 as an intermediary step. Thus, an important proportion of our academics changed their approaches by avoiding different intermediary steps. This means that changing ATs towards a consonant learning-focused is not necessary to occur by intermediary steps and could also occur as a direct shift. However, such direct changes from the left-hand start to the right-hand end of the continuum should be interpreted with due caution as evidence invalidating the existence of one continuum of ATs. Our continuum included only dissonant profiles. Consequently, even the right-hand end of the continuum (Profile 2) could be (at least theoretically) an intermediary step to a well-established consonant learning-focused profile.

Some previous studies (e.g., McMinn et al., 2020; Stes & Van Petegem, 2014) suggested that ATAs vary depending on several variables such as academics' teaching context, specialization, gender, or teaching experience. Other research (e.g., Emery et al., 2020; Mladenovic et al., 2021) presented contrary results. Also, we did not find any significant associations between the variables listed above, the pedagogical program followed by academics, academics' profiles, and their transitions from one profile to another. Regardless of which of the three programs university teachers graduated (or which demographic characteristics had), they could have similar trajectories of changing their ATs.

5.1. Implications for academic development

Our findings could have implications for developing pedagogical initiatives aimed at changing ATAs toward more LFAT. First, it is important to stress that academics enrolled in pedagogical programs could have different profiles of ATs. Thus, to increase the training effectiveness, academic developers should tailor the pedagogical

initiatives to different profile groups. A similar call was also advanced by Stes and Van Petegem (2014). Let's suppose that we could continue the pedagogical training with our sample. At the last moment of data collection, the academics in our sample are grouped into four different profiles of teaching approaches. Thus, for each group, we should design one training initiative to address academics' zone of proximal development toward a more LFAT profile. For example, the academics in Dissonant clearly defined Profile (P4) have a high score on the test-focus subscale. In this situation, we will design instructional activities to develop academics' understanding of what negative effects could have the teaching-to-the-test method on students' learning in the long term. Also, we could involve our participants in hands-on activities to design more learning-centered instructional activities as alternatives to the teaching-to-the-test method in concrete teaching contexts in which university teachers are engaged. The training programs that will address the needs and development levels of the other groups can be designed through a similar approach. Academic developers can identify the next step in each group's development towards a more LFAT approach (i.e., which is the easiest step to take?) and can engage the participants in training activities that directly and specifically address their levels of development.

Second, changing ATs could occur by different trajectories, which sometimes could be even discontinuous. Consequently, academic developers should monitor the evolution of participants' ATs across a program and should adapt the instructional design of an ongoing program based on the findings from the monitoring process. Third, there are many forms of dissonance in ATs, and the relationships between them seem to be an essential characteristic of the dynamic of change. Therefore, the possible forms of dissonance in approaches seem to be necessary training content. Thus, one could increase university teachers' awareness about their ATs using the results of the monitoring process of the dynamic of participants' ATs and designing self-reflection training activities using the description of different forms of dissonance in ATs. A possible example of self-reflection activities could be the recent initiative advanced by Parpala and Postareff (2021). This suggestion aligns perfectly with the original recommendations to use the ATI (Trigwell & Prosser, 1996).

Finally, our findings suggested that changes in ATs seem to need as a first step changes in academics' intentions to teach. Thus, instructional activities addressing changes in academics' conceptions of teaching should be included as instructional sequences in pedagogical programs before training moments handling changes in academics' instructional strategies. Several previous studies advanced similar suggestions. For example, Mladenovici et al. (2021) suggested that addressing academics' conceptions concerning the subject matter taught should be the first step in pedagogical training to raise academics' awareness about their ATs.

5.2. Limitations and implications for future research

As this study is the first to investigate changes in ATs using LPTA, more similar research is needed for more conclusive findings. Also, our study has some limitations. First, our sample is based on Romanian academics voluntarily enrolled in pedagogical programs. Nevgi, Postareff, and Lindblom-Ylänne (2004) highlighted that Finnish academics were more CFAT than English academics, and Kálmán *et al.* (2020) revealed that academics with an LFAT were more open to enrolling in pedagogical programs. Thus, our results should be taken into consideration with caution for generalize due to the academics' voluntary participation in both training and research activities. Therefore, future studies conducted in different national contexts and involving academics not enrolled (or not enrolled only as volunteers) in pedagogical training could complete our knowledge about the subject.

Second, this study had a small sample and a research design with three waves and a time lag of six months. Nylund-Gibson and Choi (2018) highlighted that LPA could be conducted optimally on a small sample size if the profiles resulted are clearly separated. However, in our case, at least the reduced sample size (N = 8) in Profile 3 could imply a low statistical power. Thus, similar studies on larger samples are needed. In addition, future studies should address attention to the time lag between measurement moments. Taris and Kompier (2014) showed that having too short time lags between waves affects the results because the expected effect may not have enough time to occur. Similarly, when the time lags are too long, the predicted effect may already have decreased or disappeared. Therefore, future studies could collect data in waves with other time lags (e.g., three or twelve months). Moreover, comparing findings from studies with different time lags between waves could reveal the optimal time lag to evaluate the dynamic of ATAs. This information could be highly relevant for designing pedagogical training and for monitoring the changes in ATAs.

Finally, it should be emphasized that our study, like most studies investigating changes in ATAs, failed to overcome the methodological limit of collecting self-reported data. In this vein, future studies could try to investigate the dynamic of ATAs by using more eclectic data-gathering techniques (e.g., classroom observations of the teaching approach or students' perception of the teaching approach). Such research design options could overcome the academics' adoption of 'socially desirable' behaviors while responding to the inventories and could provide a more reliable to understand changes in ATAs.

6. Conclusion

The results of this study suggested that ATs could be very stable over time, having slow and discontinuous dynamics of changes. Changes from CFAT to LFAT could occur as a direct shift or through different intermediary steps, described as dissonant ATs. Moreover, the results suggested that changes towards an LFAT seem to be based firstly on changes in academics' intentions to teach and only after on their decisions about instructional strategies used. Finally, this study highlighted that these dynamics of change are similar across different contextual variables (i.e., academics' teaching context, specialization, gender, teaching experience, and pedagogical training programs followed).

Conflict of interest

The authors declare that they have no conflict of interest.

Funding

The work of the authors affiliated to West University of Timișoara was supported by the Romanian Ministry of Education and Research [projects numbers POCU/320/6/21/121030, POCU/379/6/21/124874 and PN-III-P4-ID-PCE-2020-1760]. This organization had no role in the design and implementation of the study.

CRediT authorship contribution statement

Marian D. Ilie: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Visualization, Writing – original draft, Writing – review & editing. **Peter Van Petegem:** Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Velibor Mladenovici:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Software, Writing – original draft. **Laurenţiu P. Maricuţoiu:** Formal analysis, Methodology, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Data Availability

Data will be made available on reasonable request.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.stueduc.2024.101349.

References

Antoniou, P. (2013). A longitudinal study investigating relations between stages of effective teaching, teaching experience and teacher professional development approaches. *Journal of Classroom Interaction, 48*(2), 25–40.

Cao, Y., Postareff, L., Lindblom-Ylänne, S., & Toom, A. (2019). Teacher educators' approaches to teaching and connections with their perceptions of the closeness of their research and teaching. *Teaching and Teacher Education, 85*, 125–136. https://doi.org/10.1016/j.tate.2019.06.013

Cao, Y., Postareff, L., Lindblom-Ylänne, S., & Toom, A. (2021). A survey research on Finnish teacher educators' research-teaching integration and its relationship with their approaches to teaching. *European Journal of Teacher Education, 46*(1), 1–28. https://doi.org/10.1080/02619768.2021.1900111

Cassidy, R., & Ahmad, A. (2019). Evidence for conceptual change in approaches to teaching. *Teaching in Higher Education, 26*(5), 742–758. https://doi.org/10.1080/13562517.2019.1680537

Creemers, B. P. M., & Kyriakides, L. (2013). Using the dynamic model to identify stages of effective teaching: An introduction to the special issue. *Journal of Classroom Interaction, 48*(2), 4–9.

Creemers, B., Kyriakides, L., & Antoniou, P. (2013). *Teacher professional development for improving quality of teaching.* Dordrecht, the Netherlands: Springer,.

Emery, N. C., Maher, J. M., & Ebert-May, D. (2020). Early-career faculty practice learner-centered teaching up to 9 years after postdoctoral professional development. *Science Advances, 25*(6), 1–10. https://doi.org/10.1126/sciadv.aba2091

Gibbs, G., & Coffey, M. (2004). The impact of training of university teachers on their teaching skills, their approach to teaching and the approach to learning of their students. *Active Learning in Higher Education, 5*(1), 87–100. https://doi.org/10.1177%2F1469787404040463.

Hickendorff, M., Edelsbrunner, P. A., McMullen, J., Schneider, M., & Trezise, K. (2018). Informative tools for characterizing individual differences in learning: Latent class, latent profile, and latent transition analysis. *Learning and Individual Differences, 66*, 4–15. https://doi.org/10.1016/j.lindif.2017.11.001

Hicks, M., Smigiel, H., Wilson, G., & Luzeckyj, A. (2010). *Preparing academics to teach in higher education.* Final report. Sydney: Australian Learning and Teaching Council,.

Hodgson, C. S., & Wilkerson, L. (2014). Faculty development for teaching improvement. In Y. Steinert (Ed.), *Faculty development in the health professions. Innovation and changes in professional Education 11* (pp. 29–52). Springer Science + Business Media Dordrecht. https://doi:10.100/978-94-007-7612-8_2.

Ilie, M. D., Maricuțoiu, L. P., Iancu, D. E., Smarandache, I. G., Mladenovici, V., Stoia, D. C. M., & Toth, S. A. (2020). Reviewing the research on instructional development programs for academics. Trying to tell a different story: A meta-analysis. *Educational Research Review, 30*. https://doi.org/10.1016/j.edurev.2020.100331

Jacob, W. J., Xiong, W., & Ye, H. (2015). Professional development programs at world-class universities. *Palgrave Communications, 1*(2), 1–27. https://doi.org/10.1057/palcomms.2015.2

Kálmán, O., Tynjälä, P., & Skaniakos, T. (2020). Patterns of university teachers' approaches to teaching, professional development, and perceived departmental cultures. *Teaching in Higher Education, 25*(5), 595–614. https://doi.org/10.1080/13562517.2019.1586667

Kyriakides, L., Creemers, B. P. M., & Antoniou, P. (2009). Teacher behaviour and student outcomes: Suggestions for research on teacher training and professional development. *Teaching and Teacher Education, 25*(1), 12–23. https://doi.org/10.1016/j.tate.2008.06.001

Lindblom-Ylänne, S., Trigwell, K., Nevgi, A., & Ashwin, P. (2006). How approaches to teaching are affected by discipline and teaching context. *Studies in Higher Education, 31*(3), 285–298. https://doi.org/10.10800307507060068053 9

Lo, Y., Mendell, N. R., & Rubin, D. B. (2001). Testing the number of components in a normal mixture. *Biometrika, 88*(3), 767–778. https://doi.org/10.1093/biomet/88.3.767

Marsh, H. W., Lüdtke, O., Trautwein, U., & Morin, A. J. (2009). Classical latent profile analysis of academic self-concept dimensions: Synergy of person-and variable-centered approaches to theoretical models of self-concept. *Structural Equation Modeling: A Multidisciplinary Journal, 16*(2), 191–225. https://doi.org/10.1080/10705510902751010

McMinn, M., Dickson, M., & Areepattamannil, S. (2020). Reported pedagogical practices of faculty in higher education in the UAE. *Higher Education, 83*, 396–410. https://doi.org/10.1007/s10734-020-00663-7

Meyer, J. H. F., & Eley, M. G. (2006). The approaches to teaching inventory: A critique of its development and applicability. *British Journal of Educational Psychology, 76*(3), 633–649. https://doi.org/10.1348/000709905×49908

Mladenovici, V., Ilie, M. D., Maricuțoiu, L. P., & Iancu, D. E. (2021). Approaches to teaching in higher education: The perspective of network analysis using the revised approaches to teaching inventory. *Higher Education, 84*, 255–277. https://doi.org/10.1007/s10734-021-00766-9

Morin, A.J.S., & Litalien, D. (2017). Webnote: Longitudinal tests of profile similarity and latent transition analyses. Montreal, QC: Substantive Methodological Synergy Research Laboratoryhttp://smslabstats.weebly.com/uploads/1/0/0/6/100647486/lta_distributional_similarity_v02.pdf.

Morin, A. J., Gallagher, D. G., Meyer, J. P., Litalien, D., & Clark, P. F. (2021). Investigating the dimensionality and stability of union commitment profiles over a 10-year period: A latent transition analysis. *ILR Review, 74*(1), 224–254.

Morin, A. J., Maiano, C., Nagengast, B., Marsh, H. W., Morizot, J., & Janosz, M. (2011). General growth mixture analysis of adolescents' developmental trajectories of anxiety: The impact of untested invariance assumptions on substantive interpretations. *Structural Equation Modeling: A Multidisciplinary Journal, 18*(4), 613–648. https://doi.org/10.1080/10705511.2011.607714

Morin, A. J. S., Meyer, J. P., Creusier, J., & Biétry, F. (2016). Multiple-group analysis of similarity in latent profile solutions. *Organizational Research Methods, 19*(2), 231–254. https://doi.org/10.1177%2F1094428115621148.

Muthén, L.K., & Muthén, B.O. (1998-2017). Mplus User's Guide. Eighth Edition. Los Angeles, CA: Muthén & Muthén.

Muthén, B. (2003). Statistical and substantive checking in growth mixture modeling: Comment on Bauer and Curran (2003). *Psychological Methods, 8*(3), 369–377. https://doi.org/10.1037/1082-989X.8.3.369

Nevgi, A., Postareff, L., & Lindblom-Ylänne, S. (2004). The effect of discipline on motivational and self-efficacy beliefs and on approaches to teaching of Finnish and English university teachers. Study presented at SIG higher education conference, June 18–21, 2004.

Nylund, K.L., Muthén, B., Nishina, A., Bellmore, A., & Graham, S. (2006). Stability and instability of peer victimization during middle school: Using latent transition analysis with covariates, distal outcomes, and modeling extensions. Unpublished manuscript.

Nylund, K. L., Asparouhov, T., & Muthén, B. O. (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Structural Equation modeling: A Multidisciplinary Journal, 14*(4), 535–569. https://doi.org/10.10800705510701575396

Nylund-Gibson, K., & Choi, A. Y. (2018). Ten frequently asked questions about latent class analysis. *Translational Issues in Psychological Science, 4*(4), 440–461. https://doi.org/10.1037/tps0000176

Parpala, A., & Postareff, L. (2021). Supporting high-quality teaching in higher education through the HowUTeach self-reflection tool. *Ammattikasvatuksen Aikakauskirja, 23*(4), 61–67.

Peugh, J., & Fan, X. (2013). Modeling unobserved heterogeneity using latent profile analysis: A Monte Carlo simulation. *Structural Equation Modeling, 20*(4), 616–639. https://doi.org/10.1080/10705511.2013.824780

Postareff, L., Katajavuori, N., Lindblom-Ylänne, S., & Trigwell, K. (2008). Consonance and dissonance in descriptions of teaching of university teachers. *Studies in Higher Education, 33*(1), 49–61. https://doi.org/10.10800307507070179480 9

Postareff, L., Lindblom-Ylänne, S., & Nevgi, A. (2007). The effect of pedagogical training on teaching in higher education. *Teaching and Teacher Education, 23*(5), 557–571. https://doi.org/10.1016/j.tate.2006.11.013

Prosser, M., & Trigwell, K. (1999). Relational perspectives on higher education teaching and learning in the sciences. *Studies in Science Education, 33*(1), 3–60. https://doi.org/10.10800305726990856013 5

Prosser, M., & Trigwell, K. (2006). Confirmatory factor analysis of the approaches to teaching inventory. *British Journal of Educational Psychology, 76*, 405–419.

Prosser, M., Ramsden, P., Trigwell, K., & Martin, E. (2003). Dissonance in experience of teaching and its relation to the quality of student learning. *Studies in Higher Education, 28*(1), 37–48. https://doi.org/10.10800307506930929 9

Singer, E. R. (1996). Espoused teaching paradigms of college faculty. *Research in Higher Education, 37*(6), 659–679. https://doi.org/10.1007/BF01792951

Sonesson, A., & Lindberg Sand, Å. (2006, June). Compulsory higher education teacher training in Sweden – a nucleus for scholarship of teaching and learning. (Paper presented at the 6th Conference of the International Consortium for Educational Development, Sheffield).

Stes, A., & Van Petegem, P. (2014). Profiling approaches to teaching in higher education: A cluster-analytic study. *Studies in Higher Education, 39*(4), 644–658. https://doi.org/10.1080/03075079.2012.729032

Stes, A., De Maeyer, S., & Van Petegem, P. (2010). Approaches to teaching in higher education: Validation of a Dutch version of the approaches to teaching inventory. *Learning Environments Research, 13*(1), 59–73. https://doi.org/10.1007/s10984-009-9066-7

Stes, A., Donche, V., & Van Petegem, P. (2014). Understanding differences in teaching approaches in higher education: An evidence-based perspective. *Reflecting Education, 9*(1), 21–35.

Stes, A., Gijbels, D., & Van Petegem, P. (2008). Student-focused approaches to teaching in relation to context and teacher characteristics. *Higher Education, 55*(3), 255–267. https://doi.org/10.1007/s10734-007-9053-9

Taylor, K. L., & Znajda, S. K. (2014). Demonstrating the impact of educational development: The case of a course design collaborative. *Studies in Educational Evaluation, 46*, 39–46. https://doi.org/10.1016/j.stueduc.2014.11.003

Taris, T. W., & Kompier, M. A. J. (2014). Cause and effect: Optimizing the designs of longitudinal studies in occupational health psychology. *Work & Stress, 28*(1), 1–8. https://doi.org/10.1080/02678373.2014.878494

Trigwell, K., & Prosser, M. (1996). Congruence between intention and strategy in university science teachers' approaches to teaching. *Higher Education, 32*(1), 77–87. https://doi.org/10.1007/BF00139219

Trigwell, K., Prosser, M., & Ginns, P. (2005). Phenomenographic pedagogy and a revised approaches to teaching inventory. *Higher Education Research & Development, 24*(4), 349–360. https://doi.org/10.10800729436050028473 0

Trigwell, K., Prosser, M., & Taylor, P. (1994). Qualitative differences in approaches to teaching first year university science. *Higher Education, 27*, 75–84. https://doi.org/10.1007/BF01383761

Trigwell, K., Prosser, M., & Waterhouse, F. (1999). Relations between teachers' approaches to teaching and students' approaches to learning. *Higher Education, 37*, 57–70. https://doi.org/10.1023/A:1003548313194

Uiboleht, K., Karm, M., & Postareff, L. (2018). The interplay between teachers' approaches to teaching, students' approaches to learning and learning outcomes: A qualitative multi-case study. *Learning Environments Research, 21*(3), 321–347. https://doi.org/10.1007/s10984-018-9257-1