



# Work-related learning needs in university continuing education—A factor model based on Eraut’s workplace trajectories

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**Abstract** University continuing education (UCE) operates at the intersection of academic standards and professional applicability, shaped by evolving workplace demands and the lifelong learning paradigm. This study focuses on students’ expectations for skill development and adaptability, employing Eraut’s workplace learning trajectories as a framework to assess and address these needs systematically. Based on this, a factor model of work-related learning needs in UCE is developed and evaluated. CFA and SEM analyses confirm the validity and reliability of a three-factor measurement model, with robust indicators significantly measuring the latent constructs and indicating alignment between the theoretical framework and empirical data.

**Keywords** University Continuing Education (UCE) · Work-Related Learning Needs · Factor Model · Professional Skill Development · Lifelong Learning

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# Arbeitsplatzbezogene Lernbedarfe in der universitären Weiterbildung – Ein Faktorenmodell auf der Grundlage von Eraut’s Workplace Trajectories

**Zusammenfassung** Die Hochschulweiterbildung bewegt sich an der Schnittstelle zwischen akademischen Standards und beruflicher Anwendbarkeit, geprägt von den sich wandelnden Anforderungen der Arbeitswelt und dem Paradigma des lebenslangen Lernens. Diese Studie konzentriert sich auf die Erwartungen der Studierenden an ihre berufliche Kompetenzentwicklung und nutzt Erauts arbeitsplatzbezogene Lernzielpfade als Rahmen, um diese Bedarfe systematisch zu erfassen und zu adressieren. Auf dieser Grundlage wird ein Faktorenmodell arbeitsplatzbezogener Lernbedarfe für die Hochschulweiterbildung entwickelt und evaluiert. CFA- und SEM-Analysen bestätigen die Validität und Reliabilität eines Messmodells mit drei Faktoren, dessen robuste Indikatoren die latenten Konstrukte signifikant messen und eine Übereinstimmung zwischen theoretischem Rahmen und empirischen Daten aufzeigen.

**Schlüsselwörter** Hochschulweiterbildung · Berufsbezogene Lernbedürfnisse · Faktorenmodell · Berufliche Kompetenzentwicklung · Lebenslanges Lernen

## 1 Introduction

In the context of the Bologna Reform, European universities face the challenge of developing continuing education programs that align with the expectations of their students (Wolter 2017). Theoretical discourse highlights a shift towards a student-centered approach as a guiding principle for university continuing education (UCE), emphasizing the growing relevance of the continuing education market as a reference system and the adoption of increasingly market-driven practices (Rohs et al. 2023). Addressing the specific learning needs of students in UCE may contribute to its economic success. This underscores the understanding of UCE as a distinct organizational entity within the higher education landscape (Musselin 2006) and highlights its unique role as an actor within market structures (Agasisti and Catalano 2006). According to Deng (2020), these developments prompt critical questions regarding the purpose of the curriculum and knowledge in UCE. As UCE becomes increasingly integrated into the growing continuing education market, program planning is shifting to focus more on addressing contemporary issues in work and society from a student-centered perspective (Tokarski 2023).

This highlights the challenge of balancing students’ expectations with their learning needs in a market-driven environment. Students’ learning needs are particularly important, not only from the perspective of disciplinary knowledge but also in terms of a customer-oriented approach. To navigate this complexity, the planning of study programs in UCE takes place at the intersection of practical professional requirements and the transfer of academic knowledge. Given that students increasingly function as customers in market-driven continuing education institutions, their specific expectations must be carefully taken into account when designing UCE training programs. Students’ demand for continuing education is influenced by a variety of

perspectives. On one hand, it is driven by the practical applicability of job-related expertise and skills acquired during UCE training, as well as the individual benefits these provide in the labour market to achieve specific career goals (White-Hancock 2023; López 2020). This is particularly evident in disciplines where knowledge structures are heavily influenced by industrial transformations or workplace demands (Hordern 2021; Bernstein 2000, 1999). Students' individual engagement and personal responsibility for their learning are often tied to their expectations of improving employability, especially as companies face pressures to remain competitive, innovative, and productive in today's global economy. On the other hand, continuing education is framed as a social, economic, and personal necessity, aligned with the concept of lifelong learning. This perspective connects to students' aspirations and expectations about the "future of work" (Schultheiss and Backes-Gellner 2023; Ainsworth and Knox 2022; Filliettaz 2013). From the students' perspective, the benefits of UCE are influenced by both tangible factors, such as improved income, and intangible factors, such as personal development aspirations or the boost in self-confidence gained from applying new professional skills.

To address these diverse expectations, integrating work experience and lifelong learning emerges as an effective strategy for continuing education institutions (White-Hancock 2023; López 2020). In uncertain and disruptive times, individual career development becomes increasingly unpredictable (Goh 2022; Yorozu 2017; Akkermans et al. 2020). The work environment is shaped by societal upheavals and influenced by emerging conditions and paradigms, such as crisis-related threats, evolving sustainability priorities, and digital transformation. These paradigm shifts, in turn, lead to new operational patterns in the workplace and often result in dynamic performance expectations for employees. Consequently, continuous learning and training become critical factors in enhancing human capital resources and supporting organizational development (Noe et al. 2014). Additionally, learning and further training activities are closely tied to the broader expectation of improved employability (Rintala et al. 2019; Manuti et al. 2015; Kyndt and Baert 2013). For highly qualified professionals—those with a first university degree or higher vocational qualifications, who are the primary target audience for UCE—participation in continuing education is a cornerstone of career progression. Such participation is expected to stabilize their professional position and foster long-term career development (Nils 2018). As a result, there is a growing emphasis on continuing education programs and training that aligns closely with students' professional performance and work processes, tailoring the content to their real-world practices and challenges (Holzer and Riboltis 2018).

In summary, students' expectations of UCE may be shaped by various factors across the following categories, each of which can potentially impact their choices of UCE study programs, courses, and training (see Table 1).

This study focuses particularly on points (3) and (4) (see Table 1) and aims to enhance the understanding of related students' work-related learning and training needs in UCE. These learning needs play a critical role in the planning and development of continuing education programs, as they guide the creation of a program portfolio that aligns with the factors outlined in Table 3. For this reason, it is important to understand that a recontextualization of work-related learning needs occurs

**Table 1** List 1: Influencing Factors on the choice of UCE courses and training from the Students' Perspective

(1)	<i>Enhanced Employability and Career Advancement</i> The desire to improve their professional position and support long-term career development
(2)	<i>Achievement of Career Goals and Financial Growth</i> The pursuit of career plans and aspirations, including the potential for increased income
(3)	<i>Adaptability to Evolving Professional Demands</i> The need to meet dynamic performance requirements in organizations, driven by shifting paradigms, industry trends, and societal changes in the professional and work environment
(4)	<i>Personal Growth and Professional Skill Development</i> The aim to achieve personal development and enhance work-related skills for greater professional competence

within the framework of UCE planning and development. Aligned with the work-related learning needs that influence students' choice of UCE, the question arises: how can these needs be effectively addressed within formally academic yet professionally oriented UCE study programs? The practical relevance of UCE training can only be guaranteed through a deliberate recontextualization of work-related learning interests (Hordern 2014, 2018). To achieve this, a structural assessment of these learning needs is essential. In the context of lifelong learning, work is becoming an increasingly significant learning environment (Van Dellen and Cohen-Scali 2015; Filliettaz 2013). From a continuing education perspective, this necessitates a clear understanding of the specific learning needs arising from the workplace, as these are critical factors influencing students' selection of suitable UCE study programs, courses and training. In their workplaces, employees must navigate emergent day-to-day situations by applying previously acquired knowledge, skills, and competencies (Eraut 2013). Crucially, the ability to identify relevant skills and competencies, transfer them to new contexts, and integrate them with other forms of knowledge and expertise are key factors for effective learning in complex work environments (Eraut 2013, 2004). For UCE, which operates at the intersection of practical professional demands and academic knowledge transfer, anticipating these factors is increasingly important to align with students' expectations. Such alignment is a prerequisite for equipping students with the skills needed to enhance their performance and address new professional challenges effectively.

This brings up an important question: what specific learning needs should be addressed, particularly when their applicability to dynamic and increasingly complex working conditions must be considered? Furthermore, for empirical research projects like this, the question of how work-related learning needs can be effectively assessed for larger samples is of relevance. Specifically, two key questions arise in the context of quantitative research projects. The first focuses on identifying suitable theoretical frameworks to effectively describe learning needs at the intersection of workplace and UCE. The second involves the development of measurement models and survey tools that ensure an adequate level of validity and can be operationalized with reasonable effort.

Regarding a suitable theoretical approach, Eraut (2013) and Eraut et al. (2005) identify various categories of learning needs at the workplace. These categories serve as a framework for understanding work-related learning needs from the students'

**Table 2** List 2: Workplace Learning Trajectories by Eraut (2013) and Eraut et al. (2005)

Academic Knowledge and Skills
Awareness and Understanding (e.g., of context and situations, other people, strategic issues)
Decision Making and Problem Solving
Judgement (e.g., quality issues, priorities, risks)
Personal Development
Role performance
Task Performance
Teamwork

perspective, emphasizing the importance of equipping them to navigate increasingly complex situations in their daily professional activities. The workplace trajectories by Eraut (2013) and Eraut et al. (2005) focus on workplace learning, addressing the immediate work environment as the domain of investigation and encompassing several categories (see Table 2).

Beyond these categories of workplace trajectories, 53 sub-items describe a differentiated spectrum of workplace issues. According to Eraut (2013) and Eraut et al. (2005), using these items as a framework can help establish effective learning in the workplace.

In this study, the understanding of work-related learning is primarily examined from the UCE perspective. By applying Eraut's workplace trajectories to investigate students' learning needs in UCE, valuable insights can be gained into the work environment and subsequently be used for the design of study programs, courses, and training. Therefore, a practical and viable survey instrument is required.

## 2 Aims and scope

The study conducted here aims to empirically trace Eraut's workplace trajectories and, based on these, to develop a survey instrument for assessing work-related learning needs in UCE. A statistically evaluated survey instrument is to be presented, designed to assess work-related learning needs as a critical factor for planning and developing UCE study programs. Particular emphasis is placed on the development of a factor model for workplace-related learning needs and its reliability.

## 3 Method

In a pretest of the original 53 items based on Eraut (2013) and Eraut et al. (2005), including item analysis, these were reduced to 25 items, which remain assigned to the original categories of Eraut's workplace trajectories (see Table 3). Based on the feedback from the pretest participants, the content was revised in several areas to eliminate redundancy and enhance selectivity. Cronbach's alpha analysis resulted in a value of  $CA=0.924$  ( $CA$  standardised items=0.923). The removal of individual items did not significantly affect the scale's reliability; therefore, all 25 items were

**Table 3** Reduced item-list according to content categories of work-related learning needs based on Eraut (2013) and Eraut et al. (2005)

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<i>A—Decision Making and Problem Solving, Academic Knowledge and Skills, Task Performance</i>	
A1	Better handling of complex work content and problems
A2	Expansion of my practical skills
A3	Improve my communication and presentation skills
A4	Expansion of my theoretical knowledge
A5	Apply research findings in practice
A6	Improve my understanding of theories and models
A7	Improve my analytical skills
A8	Develop and manage problem-solving processes successfully
<i>B—Personal Development</i>	
B1	Coping with time pressure and increased workload
B2	Anticipate problems and risks of my actions in a professional context at an early stage
B3	Improve self-leadership and self-management
B4	Review and improve my own practice
<i>C—Awareness and Understanding</i>	
C1	Better understanding of the views and needs of others (colleagues, customers, supervisors, clients)
C2	Better understanding of contexts and situations
C3	Better understand and reduce negative emotions and stress (for me and others)
C4	Build and manage positive relationships in the work environment
C5	Better classify and understand other points of view and perspectives
C6	Improve collaboration with others in analogue and/or digital work environments
<i>D—Judgement</i>	
D1	Better understanding of strategic challenges (economic, social, ethical) and action strategies from the perspective of the organisation
D2	Assess the quality of performance and outcomes (my own and/or others)
D3	Understanding of value issues in social and societal contexts (ethics and sustainability)
<i>E—Role Performance, Teamwork</i>	
E1	Support others effectively in their learning processes
E2	Leading others effectively
E3	Manage responsibility for a team, my area of work or leadership
E4	Encourage mutual commitment and learning within a team

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retained for the analysis. The items were recorded on a Likert scale (not relevant = 1, rather not relevant = 2, partly/partially = 3, rather relevant = 4, relevant = 5).

The survey was conducted online in anonymized form between September 2022 and January 2023. The sample consists of students from various professional fields and disciplines in Swiss UCE programs during the academic years 2021 and 2022.

To assess the reliability of the scale applied here, additional analytical steps are required. In this study, the professional learning needs of UCE participants, and the planning and development of UCE tailored to these needs, form a shared context. The focus is on the extent to which these observable professional learning needs can be attributed to latent factors that, from the students' perspective, also influence their choice of continuing education. An exploratory factor analysis (EFA) is well-suited for this purpose, as it develops an analytical model that connects observable variables to underlying latent constructs. The subsequent confirmatory factor analysis (CFA) allows for the validation of the construct validity of the factor model (Byrne 2016; Gallagher and Brown 2013). Using CFA, it is possible to assess how well the theoretical factor model represents the observed data. Reliability metrics, such as Cronbach's alpha, do not allow for the estimation of measurement errors, unlike

CFA. CFA thus provides a tool that supports the assessment of both the reliability and validity of the construct measurement (Gallagher and Brown 2013; Weiber and Sarstedt 2021).

Furthermore, the potential influence of additional observable variables, which can serve as predictors—such as age, gender, current professional position, and sector—on the latent factors is also of interest. For this reason, the model validated for validity and reliability using CFA was extended to a full structural equation model.

In summary, this study proceeds according to the following sequence of steps:

- Reduction of the initial items based on Eraut's framework through pretesting and item analysis.
- Exploratory Factor Analysis (EFA).
- Use of latent factors to develop a hypothetical factor model and its statistical validation using Confirmatory Factor Analysis (CFA).
- Inclusion of predictor variables (age, gender, professional role, sector) and statistical validation of the Structural Equation Model (SEM).

## 4 Results

### 4.1 Sociodemographic data

A total of  $N = 5614$  UCE students were contacted, with  $n = 690$  students completing the questionnaire, resulting in a response rate of 12.29%.

Among them, 70.2% were female and 29.2% were male, while four respondents identified as diverse, and six did not specify their gender. The participants' ages ranged from 22 to 65 years. Age distribution was as follows: 33.48% were aged 41 to 50, 33.19% were 31 to 40, 21.64% were 51 to 65, and 11.70% were under 30 years old.

Most of the UCE students surveyed held workplace roles that required specialized technical or professional expertise (27%), management responsibility as department/team leaders or heads of offices or organizational units (29.11%), or professional management responsibility without supervisory roles (30.17%).

On average, participants had been in their current positions for 7.61 years. Regarding educational background, the majority had completed a university or university of applied sciences degree (56.8%) or obtained a higher technical or vocational education qualification (38.8%). A small proportion reported that their highest qualification was a basic vocational education (4.4%).

Participants represented a variety of professional sectors based on their current job roles. UCE students from the healthcare and social services sector constituted the largest group (53.2%) in the sample. The remaining percentages are distributed across the public sector (9.9%), education (8.4%), customer services/trade/financial services/insurance (9.1%), arts (4.6%), architecture (4.2%), and others (10.6%). The sample therefore exhibits a skewed distribution of sector representation due to the randomness of the sampling process. The researchers did not impose any pre-selection criteria regarding sector representation.

## 4.2 Exploratory factor analysis (EFA)

The exploratory factor analysis was performed in IBM SPSS Statistics (version 29) following these analytical steps: Extraction was conducted using the maximum likelihood method with varimax rotation and an anti-image correlation matrix. The matrix included measures of sampling adequacy (MSA), which indicate whether each individual item contributes to the factor analysis. Since all MSA values were  $>0.5$ , no items were excluded at this stage. Both the Kaiser-Meyer-Olkin test for sampling adequacy (0.938) and the Bartlett test for sphericity ( $p < 0.001$ ) confirmed that the conditions for conducting the factor analysis were met. Based on the screeplot, three factors were extracted. To ensure that all items were clearly assigned to factors, the threshold for factor loadings was progressively increased during the analysis. At a factor loading coefficient of at least 0.5, no cross-loadings remained. The three factors together explained 43% of the variance: Factor 1 accounted for 18.67%, Factor 2 for 13.86%, and Factor 3 for 10.58% of the variance (Table 4).

The interpretation of the factors is grounded in the theoretical assumptions regarding the expectations of highly qualified students toward UCE, in combination with the content characteristics of the items assigned to each latent factor. Specifically, the focus lies on adaptability to evolving professional demands and personal growth and professional skill development (see points 3 and 4 in Table 1).

**Factor 1: Collaborate and Lead Successfully (CLS)** Factor 1 includes items that describe learning needs associated with effective collaboration and assuming a leadership role. This factor encompasses items related to successful collaboration (e.g., C6—improve collaboration with others in analogue and/or digital work environments) and the qualitative assessment of outcomes (D2—assess the quality of performance and outcomes, both my own and others). Additionally, two specific leadership items are included: E2—leading others effectively and E3—managing responsibility for a team, my area of work, or leadership. Items addressing workplace relationships are also relevant, such as C4—build and manage positive relationships in the work environment, along with items focused on supporting work-related learning: E4—encourage mutual commitment and learning within the team and E1—support others effectively in their learning processes. Finally, A3—improve my communication and presentation skills appears to serve as a critical prerequisite for effective leadership, collaboration, and the development of productive learning environments at work.

**Factor 2: Interact and Cope Positively (IAP)** Factor 2 focuses on effective interaction with others and the ability to cope with work-related challenges on an individual level. This includes a strong emphasis on improving self-leadership and self-management (B3—improve self-leadership and self-management) as well as managing time pressure and high workloads (B1—coping with time pressure and increased workload). At the interaction level, several aspects are particularly relevant. Reducing stress and negative emotions—for oneself and in interactions with others—is identified as a key need (C3—better understand and reduce negative emotions and stress for myself and others). Additionally, the ability to anticipate the

**Table 4** Factor matrix (extraction method: Maximum likelihood, rotation method: Varimax with Kaiser normalization, rotation converged in 10 iterations)

Factor matrix	Factor 1: Collaborate and lead successfully	Factor 2: Interact and cope positively	Factor 3: Understand and apply knowledge professionally
E2—leading others effectively	0.770	–	–
E3—manage responsibility for a team, my area of work or leadership	0.733	–	–
E4—encourage mutual commitment and learning within the team	0.665	–	–
C4—build and manage positive relationships in the work environment	0.616	–	–
D2—assess the quality of performance and outcomes (my own and/or others)	0.588	–	–
E1—support others effectively in their learning processes	0.588	–	–
C6—improve collaboration with others in analogue and/or digital work environments	0.547	–	–
A3—improve my communication and presentation skills	0.510	–	–
B3—improve self-leadership and self-management	–	0.682	–
C3—better understand and reduce negative emotions and stress (for me and for others)	–	0.644	–
B1—coping with time pressure and increased workload	–	0.589	–
B2—anticipate problems and risks of my actions in a professional context at an early stage	–	0.557	–
D3—understanding of value issues in social and societal contexts (ethics and sustainability)	–	0.532	–
A7—improve my analytical skills	–	–	0.554
A4—expansion of my theoretical knowledge	–	–	0.533
A6—improve my understanding of theories and models	–	–	0.515

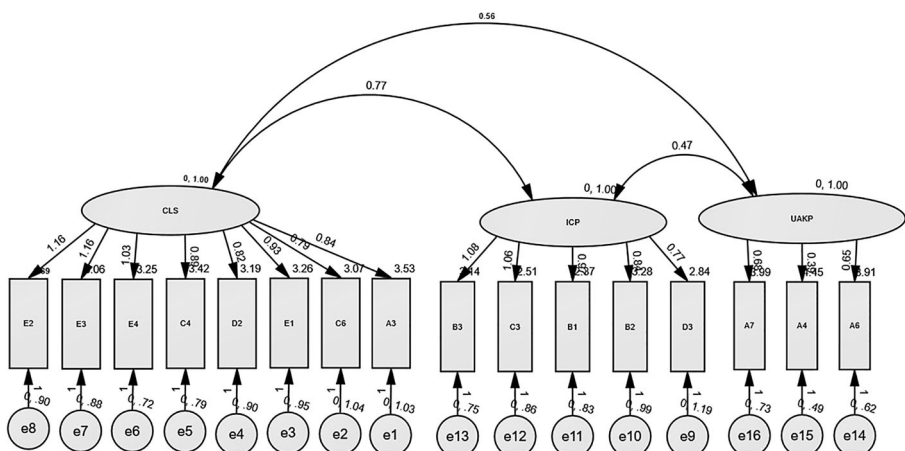
consequences of one's actions early on is highlighted as important (B2—anticipate problems and risks of my actions in a professional context at an early stage). Beyond the immediate work environment, this factor also incorporates a broader perspective, emphasizing the importance of improving one's understanding of value-related issues in social and societal contexts, particularly in areas such as ethics and sustainability (D3—understanding of value issues in social and societal contexts, including ethics and sustainability).

**Factor 3: Understand and Apply Knowledge Professionally (UAKP)** Factor 3 centers on the expansion and application of knowledge as a key consideration in selecting UCE courses and training. This factor highlights the importance of broadening theoretical knowledge within the context of one’s profession (A4—expansion of my theoretical knowledge). Additionally, it emphasizes the need to enhance the understanding of theories and models (A6—improve my understanding of theories and models) and to develop analytical skills (A7—improve my analytical skills), all of which are crucial for professional growth and effective knowledge application.

**4.3 Confirmatory factor analysis (CFA)**

In the preceding exploratory analysis, the observable variables were assigned to three latent factors, resulting in a recursive measurement model. This model can now be tested using Confirmatory Factor Analysis (CFA). Unlike exploratory factor analysis, the assignment of empirical indicators to the factors is predetermined (a priori). The purpose of CFA is to evaluate the structure and reliability of the recursive measurement model derived from the exploratory analysis (Weiber and Sarstedt 2021; Backhaus et al. 2021; Byrne 2016). CFA examines how well the theoretically based model fits the observed data. The recursive measurement model is illustrated in Fig. 1. CFA was conducted using IBM SPSS AMOS (version 29). The observed variables are listed in Table 4.

Key fit indices were examined to assess the model’s adequacy. The Chi-square test ( $\chi^2$ ) indicated 385.222, with 101 df (degrees of freedom). The comparative fit index (CFI) was 0.936, and the root mean square error of approximation (RMSEA) was 0.064, both of which suggest good model fit according to conventional thresholds (Byrne 2016; Hu-Bentler 1998). The standardized factor loadings for all items ranged between 0.488 and 0.777, indicating that the observed variables contributed significantly to their respective latent factors.



**Fig. 1** CFA Modell (*CLS* Collaborate and Lead Successfully, *ICP* Interact and Cope Positively, *UAKP* Understand and Apply Knowledge Professionally); list of observable variables see Table 4

**Table 5** AMOS Output Regression Weights; CFA Modell

			Estimate	S.E.	C.R.	<i>P</i>
A3	←	CLS	0.838	0.047	17.858	***
C6	←	CLS	0.787	0.046	16.972	***
E1	←	CLS	0.929	0.047	19.754	***
D2	←	CLS	0.817	0.044	18.469	***
C4	←	CLS	0.891	0.043	20.501	***
E4	←	CLS	1.027	0.044	23.096	***
E3	←	CLS	1.16	0.05	23.343	***
D3	←	ICP	0.771	0.05	15.433	***
B2	←	ICP	0.845	0.048	17.697	***
B1	←	ICP	0.967	0.047	20.734	***
C3	←	ICP	1.06	0.049	21.639	***
B3	←	ICP	1.084	0.047	22.963	***
A6	←	UAKP	0.649	0.05	13.022	***
A4	←	UAKP	0.392	0.037	10.47	***
A7	←	UAKP	0.676	0.053	12.7	***
E2	←	CLS	1.162	0.05	23.264	***

The latent factors CLS and ICP are very well represented by their indicators, as most factor loadings are strong ( $>0.7$ ) and all are highly significant ( $p < 0.001$ ). UAKP is less strongly represented by its indicators, particularly A4 (0.392). The high statistical significance of the loadings indicates that the relationships between the observed and latent variables are robust (see Table 5).

The covariances of the latent factors are positive and highly significant ( $p < 0.001$ ). CLS and ICP have the strongest positive covariance (0.769), indicating a close relationship. UAKP and ICP show a weaker covariance (0.467), but it is still significantly positive. UAKP and CLS exhibit a moderate covariance (0.56), which is also significant (Table 6).

Overall, the CFA supports the validity and reliability of the recursive measurement model, confirming that the three-factor structure is a suitable representation of the underlying construct.

#### 4.4 Structural Equation Models (SEM)

For each of the latent factors, the variables age, gender, professional role, and sector were included in the model. Test calculations revealed that different hypothetical assumptions about the correlation between these predictor variables have varying

**Table 6** AMOS Output Covariances

			Estimate	S.E.	C.R.	<i>P</i>
CLS	↔	ICP	0.769	0.022	34.561	***
UAKP	↔	ICP	0.467	0.048	9.774	***
UAKP	↔	CLS	0.56	0.042	13.195	***

effects on the model fit. A correlational relationship between gender and age, as well as between gender and sector, results in a better model fit for the latent variable CLS compared to scenarios where additional correlations are included. For the latent variables ICP and UAKP, better fit indices are observed when correlational relationships between gender and sector as well as age and sector are considered.

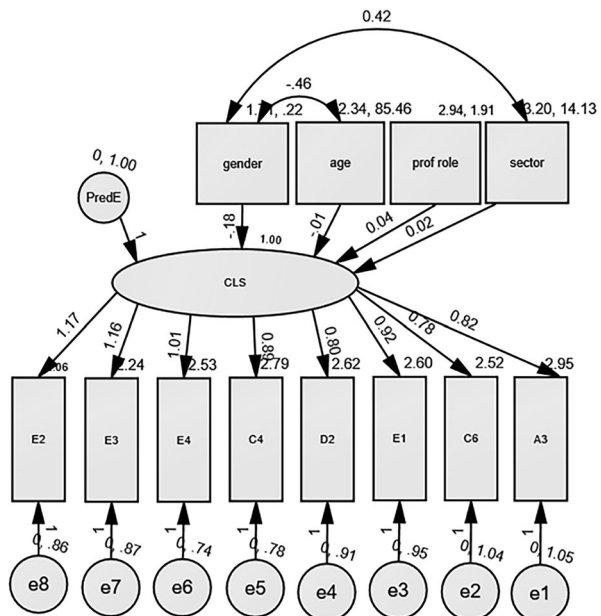
Since the predictors correlate differently for the latent factors, they will be considered separately for each latent factor, resulting in three separate SEMs (one figure for each latent factor) (Fig. 2, Fig. 3, Fig. 4).

Key fit indices were examined to assess the model's adequacy. The Chi-square test ( $\chi^2$ ) indicated 195.528, with 52 degrees of freedom (df). The comparative fit index (CFI) was 0.942, and the root mean square error of approximation (RMSEA) was 0.063, both of which suggest a moderately good model fit according to conventional thresholds (Byrne 2016; MacCallum et al. 1996). The CMIN/DF value of 3.76 supports the model's adequacy by indicating a moderate fit to the data (Marsh and Hocevar 1985). Of the four predictors, only gender has a low significant effect on the latent variable CLS ( $p=0.049$ ). The effects of age, position, and sector on CLS are not significant. Overall, the latent variable CLS is very strongly and significantly represented by its observed indicators. The relationships are all highly significant ( $p<0.001$ ), and the factor loadings are in the strong range ( $>0.7$ ) (see Table 7).

The model shows that CLS is reliably measured by the observed variables, while gender is the only weakly significant predictor. The other predictors have no notable influence on CLS. Overall, the model demonstrates a clear and robust connection between CLS and its indicators, while the predictors are less significant (Fig. 2).

Key fit indices were examined to assess the model's adequacy. The Chi-square test ( $\chi^2$ ) indicated 46.875, with 25 degrees of freedom (df). The comparative fit

**Fig. 2** SEM Modell—CLS (Collaborate and Lead Successfully) with gender, age, professional role and sector as predictors; list of observable variables see Table 4



**Table 7** AMOS Output Regression Weights; SEM Model CLS (Collaborate and Lead Successfully)

			Estimate	S.E.	C.R.	<i>P</i>
CLS	←	Gender	-0.179	0.091	-1.968	0.049
CLS	←	Age	-0.008	0.004	-1.732	0.083
CLS	←	Position	0.043	0.03	1.413	0.158
CLS	←	Branche	0.016	0.011	1.46	0.144
C6	←	CLS	0.778	0.046	16.778	***
E1	←	CLS	0.925	0.047	19.625	***
D2	←	CLS	0.804	0.044	18.111	***
C4	←	CLS	0.889	0.043	20.442	***
E4	←	CLS	1.011	0.045	22.606	***
E3	←	CLS	1.156	0.05	23.302	***
E2	←	CLS	1.17	0.05	23.591	***
A3	←	CLS	0.82	0.047	17.369	***

index (CFI) was 0.982, and the root mean square error of approximation (RMSEA) was 0.036, both of which suggest very good model fit according to conventional thresholds (Byrne 2016; Hu-Bentler 1998). The CMIN/DF value of 1.875 further supports the model's adequacy, indicating a strong fit to the data (Kline 2023). Overall, the latent variable ICP is very strongly and significantly represented by its observed indicators. The relationships are all highly significant ( $p < 0.001$ ), and the factor loadings are in the strong range ( $> 0.7$ ) (see Table 8).

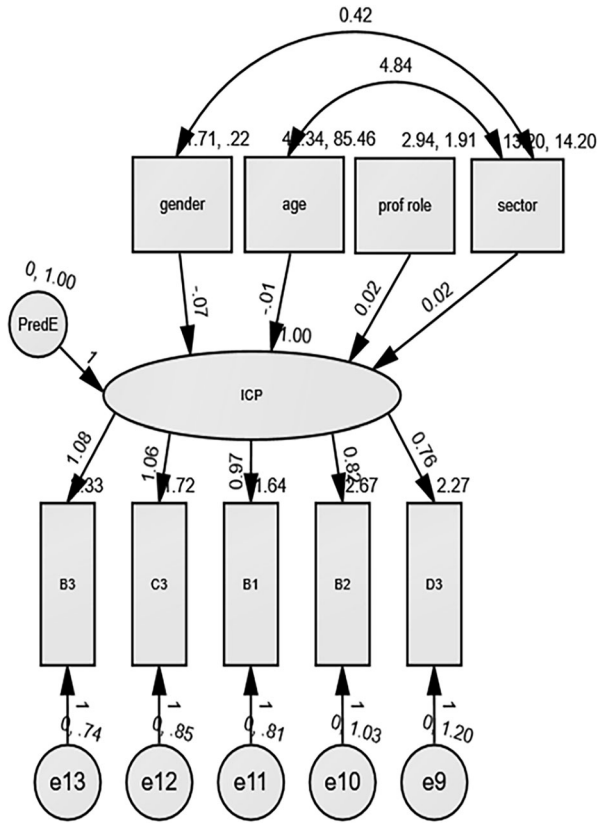
The model demonstrates that ICP is reliably measured by its indicators, while the predictors do not exert any significant influence on ICP. The indicators provide a robust and clear connection to the latent variable (Fig. 3).

Key fit indices were examined to assess the model's adequacy. The Chi-square test ( $\chi^2$ ) indicated 15.946, with 12 degrees of freedom (df). The comparative fit index (CFI) was 0.985, and the root mean square error of approximation (RMSEA) was 0.022, both of which suggest good model fit according to conventional thresholds (Byrne 2016; Hu-Bentler 1998). The CMIN/DF value of 1.329 further supports the model's adequacy, indicating a strong fit to the data (Kline 2023).

**Table 8** AMOS Output Regression Weights; SEM Model ICP (Interact and Cope Positively)

			Estimate	S.E.	C.R.	<i>P</i>
ICP	←	Gender	-0.073	0.094	-0.781	0.435
ICP	←	Age	-0.01	0.005	-2.123	0.034
ICP	←	Position	0.018	0.031	0.566	0.572
ICP	←	Branche	0.018	0.012	1.53	0.126
D3	←	ICP	0.76	0.051	14.986	***
B2	←	ICP	0.819	0.049	16.827	***
B1	←	ICP	0.973	0.047	20.645	***
C3	←	ICP	1.06	0.05	21.349	***
B3	←	ICP	1.083	0.048	22.48	***

**Fig. 3** SEM Modell—ICP (Interact and Cope Positively) with gender, age, professional role and sector as predictors; list of observable variables see Table 4

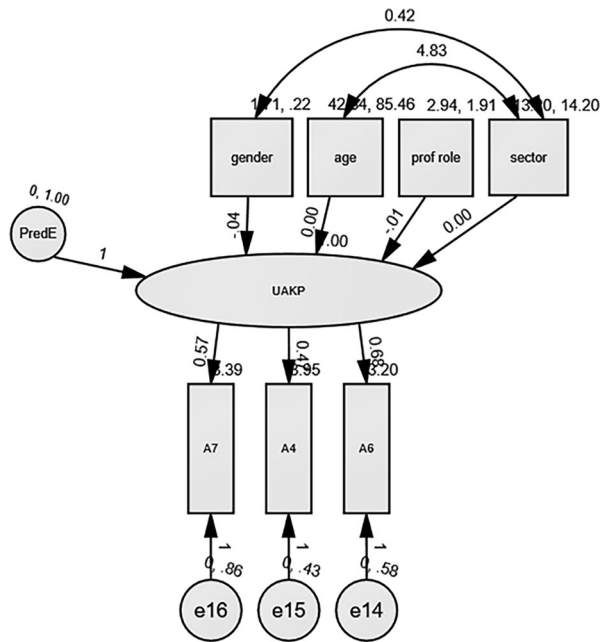


Overall, the latent variable UAKP is significantly represented by its observed indicators. The relationships are all highly significant ( $p < 0.001$ ), and the factor loadings are in a moderate range between 0.466 and 0.677 (see Table 9). The model demonstrates that UAKP is reliably measured by its observed indicators. The predictors, however, have no significant effects.

**Table 9** AMOS Output Regression Weights; SEM Model UAKP (Understand and Apply Knowledge Professionally)

			Estimate	S.E.	C.R.	P
UAKP	←	Gender	-0.036	0.111	-0.328	0.743
UAKP	←	Age	0.004	0.005	0.713	0.476
UAKP	←	Position	-0.014	0.036	-0.392	0.695
UAKP	←	Branche	0	0.013	0.001	0.999
A6	←	UAKP	0.677	0.056	12.027	***
A4	←	UAKP	0.466	0.041	11.226	***
A7	←	UAKP	0.566	0.054	10.465	***

**Fig. 4** SEM Modell—UAKP (Understand and Apply Knowledge Professionally) with gender, age, professional role and sector as predictors; list of observable variables see Table 4



## 5 Statistical conclusion

The Confirmatory Factor Analysis (CFA) and Structural Equation Models (SEMs) provide a robust validation of the measurement and structural properties of the models.

### 5.1 CFA results

The three-factor structure (CLS, ICP, UAKP) derived from the exploratory analysis is well-supported. Fit indices indicate good model fit (CFI=0.936, RMSEA=0.064), and the factor loadings demonstrate strong and significant relationships between the observed variables and their respective latent factors.

CLS and ICP are very well-represented by their indicators, with most factor loadings exceeding 0.7. UAKP is moderately represented, with its weakest indicator (A4=0.39) still contributing to the model. All covariances between the latent factors are positive and highly significant.

### 5.2 SEM results

**CLS (Collaborate and Lead Successfully)** The model fit is moderately good (CFI=0.942, RMSEA=0.063, CMIN/DF=1.875). Gender is the only predictor with a weakly significant effect ( $p=0.049$ ), while age, position, and sector have no significant impact. CLS is strongly and reliably measured by its indicators, with factor loadings >0.7.

**ICP (Interact and Cope Positively)** The model fit is excellent (CFI=0.982, RMSEA=0.036, CMIN/DF=1.875). None of the predictors show significant effects on ICP, but the latent variable is strongly represented by its indicators, with factor loadings >0.7.

**UAKP (Understand and Apply Knowledge Professionally)** The model fit is very good (CFI=0.985, RMSEA=0.022, CMIN/DF=1.329). Predictors have no significant effects, but UAKP is moderately to strongly represented by its indicators, with factor loadings ranging from 0.466 to 0.677.

**Overall conclusion** The CFA and SEM analyses confirm the validity and reliability of the recursive three-factor measurement model. While the predictors (gender, age, position, sector) show minimal to no significant effects on the latent factors, the observed indicators robustly and significantly measure the latent constructs. The models demonstrate good to very strong fit indices across all latent factors, indicating that the theoretical structure aligns well with the empirical data.

## 6 Discussion

The professional learning needs of students in university continuing education (UCE) are relevant from various perspectives. From the students' point of view, the following expectations, which were previously discussed theoretically, are particularly significant: Enhanced employability and career advancement, achievement of career goals and financial growth, adaptability to evolving professional demands, personal growth and professional skill development. From the perspective of UCE, the focus lies in anticipating students' learning needs and expectations to develop and plan continuing educational programs that are both market-relevant and in sufficient demand. Research into concrete learning needs from the students' perspective serves as a critical and helpful foundation for decision-making in the planning and development of UCE programs.

This study fulfills three key objectives. Firstly, it demonstrates that Eraut's concept of workplace trajectories is relevant for identifying work-related learning needs. Secondly, an exploratory factor analysis (EFA) was conducted, resulting in a factor model whose latent factors align with the current challenges of a dynamic working environment. Thirdly, the statistical evaluation of the factor model's reliability and validity through CFA, followed by SEM incorporating predictors. The factor model developed in this study serves as a robust measurement model for future analyses of work-related learning needs. Eraut's original, comprehensive item list (Eraut 2013; Eraut et al. 2005) was meaningfully reduced, and subsequent Confirmatory Factor Analysis (CFA) confirmed the reliability and validity of the measurement model for the dataset used in this study. The absence of significant influence from key sociodemographic variables (e.g., sector, professional role, age, gender) further underscores the robustness of the measurement model. This finding reinforces the argument that work-related learning needs are primarily shaped by the dynamics of today's work environments.

In conclusion, this has led to the development of a practical instrument that can be used to assess work-related learning needs not only in continuing education but also in other training institutions. Table 4 presents an applicable item list, validated within the framework of this study, which can be utilized for surveys. The three factors of work-related learning needs described here demonstrate a substantive relevance to the demands of an increasingly dynamic and complex working environment. As discussed, paradigm shifts and fundamental transformations in the workplace are creating dynamic performance profiles for employees. UCE, grounded in the concept of lifelong learning, reflects students' expectations about the "future of work." This study aimed to explore aspects of students' learning needs based on their actual workplace contexts. The identified latent factors of work-related learning needs address both specific skills and meta-competencies in the domains of successful leadership and collaboration, positive coping strategies, interaction, and the professional application of knowledge. Additionally, aspects of inter-individual behavior emphasize the importance of collaborative learning and fostering positive relationships within teams. Leadership and collaboration in positive, open learning environments are thus integrated within the same factor. However, coping with complex tasks in increasingly dynamic work environments also involves addressing challenges such as time pressure, increased workload, negative emotions, and stress. Enhancing self-management and self-leadership is seen as a key coping strategy that UCE students consider when selecting training programs. Anticipating the risks of actions at an early stage can also form part of individual coping strategies, aiming not only to ensure organizational success but also to minimize personal disadvantages in career development. Moreover, coping requires successful interaction with various stakeholders, which includes understanding value-based issues in social and societal contexts. This awareness of values and their implications is identified as a critical learning need for UCE programs.

Predictably, the choice of UCE training is linked to the desire to enhance theoretical knowledge. By emphasizing the improvement of analytical skills and a deeper understanding of theories and models, UCE highlights the integration of academic thinking and its application to real-world professional challenges. As stated earlier, UCE operates at the intersection of practical professional requirements and the academic transfer of knowledge, leveraging its proximity to universities as academic institutions. Learning to not only understand but also professionally apply knowledge is regarded as a crucial element in fostering future-oriented transformations in work contexts and society.

## 7 Study limitations

This study aims to develop a measurement model for assessing work-related learning needs among students in university continuing education (UCE) and to statistically evaluate its validity. As outlined, the sample exhibits a skewed distribution in terms of the sector in which the participants are employed. However, as demonstrated in the SEM analysis, the sector has no impact on the latent factors of the measurement model. Nevertheless, this aspect should be considered when applying the survey

instrument presented here. Overall, it should be noted that although the analyses provide a substantial validity assessment with an excellent model fit, the statistical findings require further confirmation through replication studies.

## Declarations

**Conflict of interest** B.M. Tokarski, A. Ferretti, M. Pfister, E. Tran and A. Gurtner declare that they have no competing interests.

**Ethical standards** Participation in the anonymous survey was voluntary and no incentives were offered. The purpose of the study and the use and storage of the data were summarised in a fact sheet on the research project. The contact details of the research group were also provided. The principles of the European Charter for Researchers | EURAXESS (europa.eu) were observed.

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