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Original research paper

## **APPROACHES TO HIGHER EDUCATION TEACHING: VALIDATION OF THE SERBIAN ADAPTATION OF THE APPROACHES TO TEACHING INVENTORY – REVISED (ATI-R)\***

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### **A B S T R A C T**

The aim of the conducted research was the construct validation of the Serbian translation of the Approaches to Teaching Inventory – Revised (ATI-R), in the domain of exploring the factor structure, which was shown to be remarkably unstable in earlier research of this kind. In addition, since the previous examinations of the ATI-R psychometric properties were mainly reduced to reliability, the second goal of the research includes psychometric validation of the instrument in the domain of reliability, validity, representativeness and homogeneity. The research was conducted on a random sample of 317 teachers and associates from 13 faculties of the University of Novi Sad, where 60.3% of respondents were female. The revised version of the inventory contains 22 items with a five-point Likert response scale. The results regarding the first objective point to a meaningful three-factor structure, which differs from the original two-factor structure in a way that the factor *Transmission of knowledge/Focus on the teacher* is decomposed into the factor *Transmission of basic knowledge/Focus on the teacher*, as

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well as the factor *Transmission of knowledge for the purpose of conceptual development and change/Focus on both actors of the teaching process*. Examination of psychometric characteristics suggests that ATI-R is the instrument with good, that is, acceptable parameters of the tested properties, which can be used both in academic and practical frameworks.

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**Key words:**

Approaches to Teaching Inventory – Revised, psychometric properties of the inventory, structural validation of the inventory.

## ■ INTRODUCTION

The research, aimed at examining the approaches to learning in higher education from the perspective of the students themselves (Biggs, 1987; Marton et al., 2005; Prosser & Trigwell, 1999; Ramsden, 2003; Trigwell & Prosser, 1991), identified a qualitative distinction between surface and deep approaches to learning. It was established that approaches to learning cannot be viewed in isolation from contextual factors, that is, they are shaped by the interaction between the student and the context of teaching and learning (Biggs & Tang, 2011). However, what still remains unapparent is the evidence that there are some ways of seeing or enacting teaching that are associated with higher-quality student learning processes or outcomes (Trigwell & Prosser, 2004). An instrument for measuring approaches to teaching, the *Approaches to Teaching Inventory* (ATI), was originally constructed to examine the relationship between the variations in the approaches to students' learning and the variations in university teachers' approaches to teaching (Prosser & Trigwell, 2006; Trigwell et al., 1999). The authors of the Approaches to Teaching Inventory (hereinafter ATI) state that in order to examine the connection between approaches to learning and approaches to teaching, it was first necessary to identify the key aspects of qualitatively different approaches to teaching, and then to develop a measurement instrument that will be ontologically consistent with the instruments that used to examine the relations between students' perceptions of the academic context and their approaches to learning (Trigwell & Prosser, 2004).

The key aspects of variations in approaches to teaching were examined using a phenomenographic approach, i.e. by analyzing the data obtained by interviewing 24 university physics and chemistry teachers (Prosser et al., 1994; Trigwell & Prosser, 1996). Based on the analysis of the interview transcripts, five qualitatively different approaches to teaching were identified that combine the strategies adopted by teachers and the intentions behind those strategies. These approaches range from those related to strategies directed at the teacher with the intention of imparting information, to those that include strategies directed at the student, with the intention of changing his/her conceptions: approach A involves a teacher-focused strategy with the intention of transmitting information; approach B refers to a teacher-focused

strategy, with the intention that students acquire the concepts of the discipline; approach C involves a strategy focused on the interaction between the teacher and the student, with the intention that students acquire the concepts of the discipline; approach D refers to a student-focused strategy aimed at students developing their own conceptions; approach E involves a student-focused strategy aimed at students changing their conceptions (Prosser, 2013; Trigwell & Prosser, 1996).

Trigwell and Prosser (1996) state that the nature of the relationship between different approaches to teaching is hierarchical; each successive approach to teaching is assessed as more complex than any other approach positioned at a lower level. These authors conclude that a key qualitative variation occurs between the *Information Transmission/Teacher-Focused* (ITTF) and the *Conceptual Change/Student-Focused* (CCSF) approaches, thus confirming the results of other research (Gow & Kember, 1993; Kember, 1997; Kember & Kwan, 2000; Norton et al., 2005; Samuelowicz & Bain, 1992) which indicate the existence of two general concepts of teaching: one, content-oriented/teacher-focused, and the other, learning-oriented/student-focused.

The initial set of items of the ATI instrument was selected from the collection of university teachers' statements. The first version of the instrument initially included a pool of 104 items, and eventually there were 16 items retained in the inventory. Since the items were related to science teaching situations, modifications were made in their wording in 1999 in order to adapt the inventory to a wider teaching context (Prosser & Trigwell, 2006; Trigwell & Prosser, 2004). Intended to measure approaches to teaching from a relational perspective, the ATI became publicly available in 1999 (Prosser & Trigwell, 1999) as an inventory consisting of two scales and four subscales: the Information Transmission/Teacher-Focused (ITTF) scale consists of eight items, four of which refer to the intentions of transmitting information, and the remaining four to the application of a teacher-focused strategy, while the Conceptual Change/Student-Focused (CCSF) scale consists of eight items, four of which refer to the intentions of bringing about conceptual changes in the student's knowledge, and the other four to student-focused strategy implementation.

In 2005, the authors of the ATI instrument (Trigwell et al., 2005) presented their revised version of the Approaches to Teaching Inventory (hereinafter ATI-R), stating that the reasons for the revision were twofold. The first reason is the belief that certain items need to be reformulated or removed from the inventory, while the second is the assessed need to expand the scope of the two dimensions or constructs of approaches to teaching, especially the ITTF dimension, which, for example, did not include items that portrayed high-quality content presentation as a part of good teaching.

In addition to researching university teachers' different approaches to teaching and their relations to students' approaches to learning (Gibbs & Coffey, 2004; Trigwell et al., 1999), the ATI and ATI-R instruments were used in research into

the contribution of pedagogical training programs to changes in university teachers' approaches to teaching (Gibbs & Coffey, 2004; Hanbury et al., 2008; Postareff et al., 2007). The ATI and ATI-R have also been used in studies examining the relationship between university teachers' approaches to teaching and other factors: perceptions of their work environment (Prosser et al., 2003; Prosser & Trigwell, 1997), disciplinary affiliation (Lindblom-Ylänne et al., 2006; Stes et al., 2014), the context in which the teaching takes place, and the teacher's personal characteristics (Stes et al., 2008), collection of teaching methods (Coffey & Gibbs, 2002), emotional experiences of teachers (Kordts-Freudinger, 2017; Trigwell, 2012; Zhang, 2004), and ways of integrating teaching and research (Cao et al., 2023).

### **Preliminary Verification of the Inventory Structure**

The authors of the ATI inventory (Trigwell & Prosser, 2004) verified its structure on a sample of 656 university teachers from various academic disciplines in over 15 countries. The factor structure of the ATI was verified using confirmatory factor analysis, which was performed on data collected from a sample of over 1,000 university teachers from various disciplines in various countries in the Western university context (Prosser & Trigwell, 2006). In both studies, it was concluded that the ATI is a valid and reliable instrument for determining variations in approaches to teaching, although in the latter study, the very high correlations between the subscales of intentions and strategies suggest a two-factor solution. The results also indicate acceptable psychometric properties of the revised inventory, the ATI-R (Trigwell et al., 2005). Other studies that analyzed the reliability and validity of the ATI (Stes et al., 2008) and ATI-R (Cao et al., 2019; Goh et al., 2014; Harshman & Stains, 2017; Monroy et al., 2015; Stes et al., 2010), on samples from university teachers in different cultures, gave a wide range of results, with differences in the factor solutions in cross-cultural adaptation of the measuring instruments. Although the ATI (Trigwell & Prosser, 2004) and ATI-R (Trigwell et al., 2005) are considered valid and reliable instruments for determining university teachers' approaches to teaching, the research indicates (Meyer & Eley, 2006; Stes et al., 2010) that it is important for the results obtained with the ATI and ATI-R not to automatically fit into the proposed two-factor structure, and that future research should check the differences in the factor structure when it comes to the implementation of the inventories in different cultures.

Bearing in mind the striking inconsistency of research findings regarding the factor structure of the ATI-R, as well as the fact that in the current research, this version of the instrument was applied for the first time within the Serbian-speaking area, the main goal of the current research relates to the structural validation of the Serbian adaptation of the ATI-R, which implies the exploration of the latent space of measurement of the given inventory. In addition, by reviewing the findings of earlier

research, the general trend of verifying the psychometric properties of the ATI-R was established almost exclusively in the domain of reliability of the internal consistency type, so the second goal of the research included the validation of the instrument in a wider range of psychometric properties, which apart from reliability, includes the parameters of it includes the parameters of representativeness, homogeneity and validity.

## ■ METHOD

### Sample

The research sample consisted of a total of 317 teachers and associates from the University of Novi Sad, 60.3% of whom were female. The largest percentage of the respondents are older than 45 (37.9%), a slightly smaller percentage is between 35 and 45 years of age (33.4%) and the smallest group are those younger than 35 (28.7%). In accordance with this, the majority of the respondents are professors (73.8%), compared to 26.2% teaching assistants, and with more than 10 years of work experience (62.1%). The structure of the sample by scientific field consisted of 47% of teachers from the field of social sciences and humanities, an equal percentage of teachers (19.9%) from technical-technological and natural sciences, 11% from the field of medical sciences, and 2.2% from the field of arts. The sample was adequate and included teachers from 13 faculties within the University of Novi Sad.

### Instrument

This research implemented the ATI-R, with the prior permission and consent of the authors of the instrument (Prosser & Trigwell, 1999; Trigwell et al., 2005). While the original version of the instrument had 16 items, based on the wide application and validation of the instrument on different samples, that version underwent a transformation and in 2005 a revised version was constructed, where some items were reformulated, one was dropped, and both teaching approaches were supplemented and expanded with new items. Accordingly, the revised instrument contains a total of 22 items and consists of two scales (CCSF and ITTF) with 11 items for each teaching approach (Trigwell et al., 2005). The items are evaluated on a five-point Likert scale depending on how often a particular item applies to the respondent/teacher (1 - rarely or never; 2 - sometimes; 3 - about half the time; 4 - often; 5 - almost always or always). The instrument was translated into Serbian using the back translation method that is most often recommended for the validation of

instruments in cross-cultural research (Cha et al., 2007). Table 1 shows examples of items for both teaching approaches.

**Table 1.** Examples of the ATI-R items

| Examples of the ATI-R items                           |  |
|---|--|
| Conceptual change/<br>Student-Focused<br>(CCSF)       | 5. I set aside some teaching time so that the students can discuss, among themselves, key concepts and ideas in this subject.<br>17. I see teaching as helping students develop new ways of thinking in this subject.<br>20. Teaching in this subject should help students question their own understanding of the subject matter. |
| Information<br>Transmission/Teacher-Focused<br>(ITTF) | 9. I structure my teaching in this subject to help students to pass the formal assessment items.<br>1. In this subject students should focus their study on what I provide them.<br>16. In this subject my teaching focuses on the good presentation of information to students.   |

The authors of the revised instrument also pointed out its satisfactory psychometric properties. To check the assumed factor structure, they used confirmatory factor analysis. The one-factor model of the ATI-R scale showed a poor fit - CFI=0.70, NNFI=0.68, RMSEA=0.14 (90% confidence interval 0.133–0.144), SRMR=0.12. However, the two-factor model excluding the three items that had saturations lower than 0.4 showed a significantly better fit CFI=0.95, NNFI=0.94, RMSEA=0.06 (90% confidence interval 0.057–0.072), SRMR=0.08, and was accepted as an optimal model (Trigwell et al., 2005). The authors also determined that Cronbach’s values indicate that both subscales have satisfactory reliability, whose values are clearly acceptable by typical psychometric conventions (Trigwell et al., 2005).

### Research Procedure

The research was carried out in December 2021 and January 2022, and the data was collected using a standard paper-and-pencil method of filling out the inventory. The respondents were instructed how to fill it out, and they also received information about the goals and importance of the research. Participation in the research was anonymous and voluntary; the respondents did not receive any compensation for their participation. The data collected through the inventory were analyzed using the software package SPSS for Windows, version 25.

## RESULTS

### Analysis of Descriptive Indicators

Inspecting Table 2, it is possible to determine that the construct measured by the ATI-R instrument has a normal data distribution. Namely, based on the inspection of the values of the skewness and kurtosis coefficients of the distribution ( $-1 < Sk, Ku < 1$ ), their compliance with standard recommendations for research in social sciences and humanities (Tabachnick & Fidell, 2021) can be observed. The mean value of the total score on the inventory indicates the representation of university teachers' tendencies towards the application of different approaches to teaching.

**Table 2.** Descriptive indicators

|                        | M     | SD   | min   | max    | Sk    | Ku    |
|------------------------|-------|------|-------|--------|-------|-------|
| Total score with ATI-R | 81.89 | 8.26 | 58.00 | 100.00 | -0.25 | -0.17 |

### Factor Analysis of the ATI-R Instrument

In accordance with the first research objective, in the initial phase of the ATI-R instrument validation, factor analysis was applied with the aim of reducing the wide range of variations in approaches to teaching to the smallest possible number of latent constructs. Based on the value of the Kaiser-Meyer-Olkin sampling adequacy index ( $KMO=.819$ ) that exceeds the recommended value of .60, as well as the statistically significant Bartlett's sphericity test ( $\chi_2(231)=1778.63; p<.01$ ), the factorability of the correlation matrix of the measuring instrument variables was established. By applying the principal components model, with Promax rotation with Kaiser normalization, five factors with a characteristic root value above 1 were identified. However, taking into account knowledge about the insufficient precision of the Kaiser-Guttman criterion, which tends to overestimate the number of factors (Keith et al., 2016), a decision on the number of factors to keep was made, based on Horn's parallel analysis, which is evaluated as a superior option compared to other procedures in the review of the popular criteria for determining the number of factors (Subotić, 2013). A parallel analysis was conducted within the program Monte Carlo PCA for Parallel Analysis (Watkins, 2000). Upon inspecting Table 3, it is possible to establish that three factors have higher values of characteristic roots of actual data than their random counterparts with corresponding values obtained on randomly generated data and that the mentioned factors cumulatively explain 41.85% of the variance of the set of measured variables. However, despite the shortcomings of conventional

procedures that generally overestimate the number of factors (Subotić, 2013), the three-factor solution is also suggested by the Scree test, which quite clearly points to the presence of three points that precede the break of the curve within the scatter diagram of eigenvalues (Chart 1 in the Appendix). In addition, taking into account the trend of the monotonous decrease in the percentage of explained variance registered after the third factor, it is possible to draw the conclusion that the Kaiser-Guttman criterion also conditionally supports the three-factor solution.

**Table 3.** Coverage of the latent space variance of the ATI-R and parallel analysis results

| Factor | Initial the solution |            |              | CV – PA | Decision |
|--------|----------------------|------------|--------------|---------|----------|
|        | ACV – PCA            | % variance | Cumulative % |         |          |
| 1      | 4.47                 | 20.33      | 20.33        | 1.51    | Accept   |
| 2      | 3.29                 | 14.94      | 35.27        | 1.42    | Accept   |
| 3      | 1.45                 | 6.57       | 41.85        | 1.35    | Accept   |
| 4      | 1.26                 | 5.74       | 47.59        | 1.30    | Reject   |
| 5      | 1.13                 | 5.21       | 52.80        | 1.25    | Reject   |

*Note.* ACV – actual characteristic value from the principal component model, CV – PA – characteristic value obtained through parallel analysis.

Based on the assembly matrix shown in Table 4, it can be observed that the first extracted factor is mostly saturated with items that reflect the intention of university teachers to encourage students' mental activity in two important domains: changes in the understanding of the subject matter (conceptual changes) and the development of new ways of thinking about the subject matter, based on the reconstruction of existing knowledge (conceptual development). If we pay attention to the teachers' *strategies*, which represent another key aspect of variations in approaches to teaching (Prosser & Trigwell, 2006), it is noticeable that the composition of the first factor is also defined by the items that imply a high degree of focus on teacher-student interaction, i.e. focus on the student. Considering the previously described structure of the first factor, it could be named *Conceptual Development and Change/Student-Focused*. The second isolated factor gathers the items that reflect the teachers' intention to deliver basic knowledge of a certain subject to students to help them pass the exam, while the teachers' strategies indicate a high degree of focus on their

own activities in the teaching process. According to this structure, the second factor is named *Basic Knowledge Transmission/Teacher-Focused*. Finally, an insight into the structure of the third factor indicates its predominant saturation with items that operationalize the teacher's intention to effectively deliver to students as much knowledge as possible from the given subject, which implies going beyond the basic knowledge that strictly results from the requirements of the examination, i.e. the criteria of passing the exam. These teacher intentions are accompanied by a strategy that primarily reflects the teachers' focus on their own effective teaching activities. However, taking into account the findings that indicate that the three items that reflect the teacher's intention to promote conceptual development and change have secondary saturations on the third factor (Table 4), a comprehensive review of the structure of this factor leads to the conclusion that its meaning can be described in terms of efficient knowledge transmission, which is a prerequisite for activating students in the domain of understanding the subject matter and progressive thinking about new matter. Thus, the third factor reflects the dual intentions and dual focus of the teacher, which is why it seems meaningful to name it *Knowledge Transmission in Service of Conceptual Development and Change/Focus on both actors of the teaching process*. The conceptual overlap of the third factor with the first and second is indicated by the results of the intercorrelations of the isolated factors, from which it can be seen that the first and third factors achieve a correlation of .14, while the correlation between the second and third factors is .18. Finally, based on Table 4, it is registered that the factor loadings of two items are lower than .30 in the case of all the three factors (item 6: *In this subject I concentrate on covering the information that might be available from key texts and readings* and item 14: *It is better for students in this subject to generate their own notes rather than copy mine*). From the content of the items, it is possible to conclude that paying attention to the sources from which students learn within the given subject is not relevant for understanding latent constructs within the approach to teaching.

**Table 4.** Factor structure of the ATI-R: pattern matrix of the three-factor solution

| Items  | 1   | 2   | 3    |
|--|-----|-----|------|
| In teaching sessions for this subject, I deliberately provoke debate and discussion.   | .79 |     |      |
| A lot of teaching time in this subject should be used to question students' ideas.   | .69 |     |      |
| I make available opportunities for students in this subject to discuss their changing understanding of the subject.                        | .68 |     |      |
| In my interactions with students in this subject I try to develop a conversation with them about the topics we are studying.               | .67 |     |      |
| I set aside some teaching time so that the students can discuss, among themselves, key concepts and ideas in this subject.                 | .66 |     |      |
| Teaching in this subject should include helping students find their own learning resources.  | .65 |     |      |
| I see teaching as helping students develop new ways of thinking in this subject.   | .59 |     | .37* |
| Teaching in this subject should help students question their own understanding of the subject matter.                                      | .54 |     | .38* |
| In teaching this subject it is important for me to monitor students' changed understanding of the subject matter.                          | .49 |     | .41* |
| I encourage students to restructure their existing knowledge in terms of the new way of thinking about the subject that they will develop. | .48 |     |      |
| It is better for students in this subject to generate their own notes rather than copy mine.   |     |     |      |
| I structure my teaching in this subject to help students to pass the formal assessment items.  |     | .76 |      |
| In this subject, I provide the students with the information they will need to pass the formal assessments.                                |     | .70 |      |
| In this subject students should focus their study on what I provide them.  |     | .60 |      |
| It is important that this subject should be completely described in terms of specific objectives that relate to formal assessment items.   |     | .58 |      |
| I present material to enable students to build up an information base in this subject.   |     | .45 |      |
| My teaching in this subject focuses on delivering what I know to the students.   |     |     | .61  |
| In this subject my teaching focuses on the good presentation of information to students.   |     |     | .57  |

|  |     |
|--|-----|
| I think an important reason for running teaching sessions in this subject is to give students a good set of notes. | .53 |
| I should know the answers to any questions that students may put to me during this subject.                        | .52 |
| It is important to present a lot of facts to students so that they know what they have to learn for this subject.  | .47 |
| In this subject I concentrate on covering the information that might be available from key texts and readings.     |     |

Note. \*Cross-loading items.

### Psychometric Properties of the ATI-R Instrument

Further validation of the inventory involved the application of a modified SPSS macro for evaluating the metric characteristics of composite measuring instruments RTT9G, version 2.3 (Knežević & Momirović, 1996). This macro was used to check the measures of validity, reliability, representativeness and homogeneity of the instrument. (Bearing in mind the problematic status of the items 6 and 14, this segment of the paper provides a comparative overview of the metric characteristics of the inventory as a whole and the metric characteristics of the version of the inventory without the two mentioned items. Taking into consideration the previously determined multidimensional structure of the inventory as well, Table 5 shows the parameter values for each of the subscales, which are defined by isolated factors.

**Table 5.** Metric characteristics of the ATI-R

| The ATI-R Versions/Subscales  | Reliability |     | Representativeness | Homogeneity |       |
|---|-------------|-----|--------------------|-------------|-------|
|   | $\alpha$    | RHO | KMO                | $\Psi_2$    | $H_2$ |
| ATI-R   | .80         | .87 | .90                | .78         | .45   |
| ATI-R without the items 6 and 14  | .79         | .86 | .92                | .81         | .47   |
| Conceptual Development and Change/<br>Student-Focused   | .84         | .85 | .94                | .86         | .83   |
| Basic Knowledge Transmission/Teacher-<br>Focused  | .69         | .68 | .77                | .57         | .82   |
| Knowledge Transmission in Service of<br>Conceptual Development and Change/Fo-<br>cus on both actors of the teaching process | .67         | .65 | .76                | .59         | .83   |

Note.  $\alpha$ =reliability measure under the classic summation measurement model, RHO=reliability measure under Guttman's measurement model, KMO=Kaiser-Meier-Olkin representativeness measure,  $\Psi_2$ =Kaiser-Rice representativeness measure,  $H_2$ =Momirović's homogeneity measure.

The values of Cronbach's alpha coefficient, as well as the RHO reliability measure under Guttman's measurement model, indicate a "good" internal consistency of the inventory with all items, as well as without the debatable items 6 and 14. The difference in the values of the reliability parameters for the two versions of the inventory is negligible. The validity was calculated at the item level and ranges from .25 to .57, where it is important to emphasize that it is the validity of the variables in the Burt table that represents the uncorrected correlation with the total score. It was determined that item 6 (validity coefficient is .25) and item 14 (validity coefficient is .26) have the lowest validity coefficients at the item level. The normalized KMO representativeness measure, according to Kaiser's vivid description, is normalized as "wonderful" (value above .90) for both versions of the inventory. The high representativeness is evidenced by the Kaiser-Rice representativeness measure  $\Psi_2$ , which, as in the previous case, is somewhat higher for the version of the inventory without the two debatable items. The homogeneity of both versions of the inventory is negligibly different and not particularly high.

When it comes to the psychometric properties of the individual subscales, *Conceptual Development and Change/Student-Focused* has good reliability, under both classical summation and Guttman's measurement models. However, in the case of the subscale *Basic Knowledge Transmission/Teacher-Focused*, as well as the subscale *Knowledge Transmission in Service of Conceptual Development and Change/Focus on both actors of the teaching process*, the values of Cronbach's alpha coefficient indicate "minimally acceptable" reliability (DeVellis, 1991), while the values of the RHO reliability measure are slightly below the "lower limit of adequacy" (Cicchetti, 1994). The validity of the items within the first subscale ranges from .54 to .70, within the second subscale from .56 to .73, while within the third subscale the range is observed from .62 to .71. According to Kaiser's mentioned description, the normalized KMO measure of representativeness is normalized as "wonderful" only in the case of the first subscale, whereas it is "fair" in the case of the second and third (value above .70). This trend is also confirmed by the Kaiser-Rice representativeness measure  $\Psi_2$ . Homogeneity in the case of all three subscales is equally high.

## ■ DISCUSSION

### Factor Structure of the ATI-R Instrument

Examining the structure of different versions of the ATI instrument, which has been identified as a research problem in dozens of studies worldwide, is largely motivated by the intention of validating the dualistic conception of approaches to teaching (ITTF and CCSF approaches), which is the theoretical basis of this instrument. By

exploring its latent space of measurement the authors of the inventory determined a two-factor solution that corresponds to the provisions of the dualistic conception of the approach to teaching (Trigwell & Prosser, 2004), and somewhat later obtained empirical confirmation of the two-factor structure of the inventory and the application of confirmatory factor analysis (Prosser & Trigwell, 2006). The measurement space of the ATI instrument has been described in terms of the mentioned two factors and in a significant number of studies outside the English-speaking area (Goh et al., 2014; Monroy et al., 2015; Rosário et al., 2013; Stes et al., 2010; Tezci, 2017). However, an extensive meta-analytic study investigating the psychometric properties of this instrument points to the striking instability of its factor structure, which is reflected in the ability to distinguish at least 26 specific factor solutions (Harshman & Stains, 2017).

When it comes to the structure of the revised version of the inventory, the aforementioned meta-analytic approach indicates multiple possibilities of organizing the items into three factors (see Harshman & Stains, 2017). Namely, in some earlier research, *Information Transmission/Teacher-Focused* stands out as a well-known factor, while the other two factors offer a different insight into the way the remaining items are organized, which are divided between the *Student-Focused* factor and the *Discussion-Focused* factor (Goh et al., 2014; Stes et al., 2010). Such findings correspond to a certain extent with the findings of the current research, because in both cases the focus on the teacher and the focus on the student are shown to be insufficiently exhaustive categories of teacher strategies, which overlook an important aspect of the interaction between teachers and students, which is in the current research marked as the focus on both actors of the teaching process. It was precisely the lack of focus on the “transitional” category of teacher-student interaction that was the origin of sharp criticisms of the dualistic conception of approaches to teaching, whose conceptual framework was considered too restrictive to properly represent the five varieties of approaches to teaching (Samuelowicz & Bain, 2001). Consequently, the third isolated factor, which reflects the focus on both actors of the teaching process, can be considered as meaningfully structured. However, a significantly higher degree of concordance between the findings of current and earlier research is observed within the three-factor structure of the revised version of the inventory, which is described in terms of *Knowledge transmission, Examination-Focused* and *Student-Focused* (Chen & Brown, 2016). This structure of the inventory corresponds to a significant extent to the way the items are distributed in the current research because in both cases the intention of knowledge transmission appears in a double form: the transmission of basic knowledge that serves the purpose of passing an exam and the transmission of knowledge at a higher level that goes beyond the requirements of the examination. Other authors also mention the approach to teaching which is organized around the preparation of students for taking exams (Goh et al., 2014; Stes et al., 2010). Possible reasons for distinguishing the knowledge transmission factor

into the two mentioned components concern the dependence of the inventory on the cultural context, as highlighted by the authors of the inventory themselves (Prosser & Trigwell, 2006). It is quite possible that an inconsistent structure of inventories is obtained in different research because cultural differences generate unequal circumstances within the higher education system (Stes et al., 2010). In the case of the results of the current research, the tendency towards the manifestation of knowledge transmission in the form of two related, but qualitatively different combinations of teachers' intentions and strategies most likely stems from the "weakest point of the reform of higher education in Serbia", which is reflected in the absence of clearly defined educational outcomes (Despotović, 2014). Namely, the critical reviews of the implementation of the principles of the Bologna Declaration in Serbia predominantly target a "vague and trivial" definition of the learning outcomes, which most often resort to the formulation of the type "upon completing the course, the students will be able to continue with further acquisition of knowledge" (Despotović, 2014, p. 52). Therefore, the acquisition of knowledge that is the basis of further learning in the given discipline is usually indicated as the central backbone of educational outcomes, which is why it is possible to explain the intentions of teachers to put the transmission of knowledge into the function of passing an exam as a prerequisite for continued learning (another isolated factor), but also the intention to present the subject matter from the given discipline in a way that enables the acquisition of a higher knowledge level - well, in detail, with ready answers to all student questions and with an effort to deliver to the students everything they know from the given discipline (third isolated factor).

In addition, relevant research points out that university teachers have two highly expressed orientations: orientation towards exams and orientation towards their own teaching activities (Chen, 2015; Watkins & Zhang, 2006), which to a considerable extent explains the intentions of placing knowledge transmission in the context of examination, thereby offering additional confirmation of the meaningfulness of the structure of the second isolated factor. In order to obtain an additional explanation for the structure of the third isolated factor, we relied on the understanding of the dissonant approach to teaching, which combines the elements of the *Information Transmission/Teacher-Focused* and *Conceptual Change/Student-Focused* approaches. Namely, previous research points out that most teachers resort to a dissonant teaching approach, which represents a transition between the two extremes of the approaches to the teaching continuum (Postareff et al., 2008; Stes & Van Petegem, 2014). In other words, the dissonance within the transitional form of approaches to teaching is reflected in the effort of teachers to encourage independent learning activities that are a prerequisite for conceptual change, with a simultaneous tendency to maintain a position of authority in the given area of knowledge (Postareff et al., 2023).

Finally, the first identified factor labelled as *Conceptual Development and Change/Student-Focused* is shown to be the most consistent form of approach to teaching across various studies. More precisely, in the meta-analytic study of the factor structure of the ATI-R, a high degree of agreement is found in the findings regarding the structure of the mentioned factor, which, according to the original idea of the author of the scale, almost without exception has the meaning of teachers' focus on the learning process/students, instead of on the content of learning/personal activities (Harshman & Stains, 2017). However, the results of the current research do not support the established point of view that within the five teaching approaches (A, B, C, D, E), there is a striking qualitative transition noted between the approaches C and D (Prosser, 2013). The obtained results show certain aspects of knowledge transmission related to mastering the concepts of the given discipline (approach B), as well as the interaction of students and teachers (approach C) in the light of the introduction to conceptual development and change, from which it follows that a qualitative transition can rather be indicated between an approach that places students in the role of passive recipients of prepared information (approach A) and an approach in which the beginning of active adoption of concepts from the given discipline is recorded while stimulating understanding (approaches B and C).

### **Psychometric Properties of the ATI-R Instrument**

The meta-analytic focus of the study by Harshman and Stains (Harshman & Stains, 2017) also included a thorough presentation of previous reliability checks of the inventory on approaches to teaching, i.e. its two subscales, which confirm the propositions of the dualistic conception of approaches to teaching. The general conclusion is that both subscales have an acceptable level of internal consistency (Cronbach's alpha value above .70), with the reliability of the CCSF subscale being slightly higher than the reliability of the ITTF subscale. In the current research, the reliability was examined under the classic summation and Guttman measurement model, for both versions of the inventory as a whole, as well as for the obtained subscales. As stated in the interpretation of the results, only the subscale *Basic Knowledge Transmission/Teacher-Focused* and the subscale *Knowledge Transmission in Service of Conceptual Development and Change/Focus on both actors of the teaching process* have "minimally acceptable" reliability under the classic summation model, i.e. reliability slightly above the "lower limit adequacy" under Guttman's measurement model. The slightly lower values of the reliability parameters for the mentioned two subscales could be related to the knowledge that they include only five items each, in contrast to the subscale *Conceptual Development and Change/Student-Focused*, which contains twice as many items, and consequently has better reliability (Boyle, 1991). In addition, in the case of the third subscale, a slightly lower degree of coherence of the measurement items is noted, primarily because this scale

covers various aspects of teachers' intentions to deliver knowledge (good, detailed, with ready answers to all student questions and with an effort to deliver to students everything they know about the given discipline), which can be related to the lowest parameters of its reliability (McCrae et al., 2011).

Validity calculated at the item level is slightly lower for both versions of the inventory as a whole in relation to the individual subscales, which means that the inventory as a whole measures what it should measure to a lesser extent, in relation to the individual subscales. In other words, the initial idea of the authors of the instrument was to construct an inventory that measures variations in approaches to teaching between the two extremes, whereby the selection of items was reduced to only the items that operationalize precisely the extreme types of approaches to teaching: the ITTF approach and the CCSF approach (Stes et al., 2010). Therefore, the lower values of the validity parameters at the level of all items from the inventory call into question the author's intention that the inventory for the object of measurement has two extreme categories of approaches to teaching, which properly reflect the varieties of this phenomenon. In addition, the research determined that the lowest validity coefficients at the item level are the debatable items 6 and 14. Bearing in mind the findings that indicate that these are the only two items in the inventory whose factor loadings do not exceed the threshold value of .30 in the case of all three isolated factors, we recommend excluding them from the revised version of the inventory. The values of the parameters of representativeness and homogeneity, which are somewhat higher in the case of the version of the inventory without the two debatable items, provide a basis for such a recommendation, while the reliability does not change significantly in the shorter version of the inventory. The representativeness of the inventory and its subscales ranges from "wonderful" to "fair", which leads to the conclusion that the items in the inventory as a whole, as well as in the individual subscales, well represent the universe of all items that have the same object of measurement. Homogeneity at the subscale level leads to the conclusion that the respondents' results concerning the items that form individual subscales depend on the same object of measurement and that the three categories of approaches to teaching that represent the object of measurement of the given subscales can be unambiguously concluded.

## ■ CONCLUSION

The results of the Serbian validation of the ATI-R instrument suggest a meaningful three-factor structure that offers the possibility of determining the degree of expression of three categories of university teachers' approaches to teaching – *Conceptual Development and Change/Student-Focused*, *Basic Knowledge Transmission/Teacher-Focused* and *Knowledge Transmission in Service of Conceptual Development and Change/Focus on both actors of the teaching process*. Psychometric parameters lead to the conclusion that it is an instrument with good psychometric properties, primarily in terms of validity and reliability, which additionally makes it recommendable for application in multiple frameworks. In addition to representing a contribution to the body of scientific knowledge and opening up new opportunities for research and monitoring of university teachers' approaches to teaching in the Serbian context, the findings of the current research also have significant practical implications. It is about the fact that the application of the ATI-R instrument can ensure adequate support for university teachers in the processes of awareness of intentions and understanding of the strategies they apply in teaching. In this sense, the ATI-R instrument can be used as a tool for teachers' self-evaluation, that is, as a tool for reflection on personal assumptions and personal actions. In the context of considering the practical implications of the research findings, it is important to note that the authors of the original instrument (Prosser & Trigwell, 2006; Trigwell et al., 2005) did not conceptualize this inventory as a tool for classifying university teachers, nor for assessing teachers' general orientations in teaching but before their specific responses to a particular teaching context. However, although university teachers' teaching approaches may change depending on the context in which the teaching takes place, the results obtained from the application of the ATI-R instrument can provide significant information about the intentions of university teachers that underlie the adopted strategies, as well as being an opportunity for developing fruitful discussions of the values and limitations of different teaching approaches in specific contexts. In this regard, the findings obtained by applying the ATI-R instrument provide a basis for the creation and modification of the pedagogical training program for university teachers in order to provide them with appropriate support in the processes of reflection on important issues of teaching and learning, on their personal goals in a specific teaching context, and thus and in introducing adequate changes in teaching practice in order to better support student learning.

Finally, the conducted research is not completely free from certain limitations. The validation of the Serbian adaptation of the ATI-R instrument would undoubtedly gain value if the construct validation was performed not only in the domain of structural but also in the domain of convergent validity, which would imply a comparison of the ATI-R instrument with an instrument that has a similar object of

measurement. However, based on knowledge of the limited methodological scope of current research, it is possible to derive recommendations for future research. In this regard, the draft of the next research envisages conducting a confirmatory factor analysis, which would test the obtained three-factor solution on a new sample of university teachers, as well as conducting a correlation analysis, to link the established varieties of teaching approaches with learning approaches. This idea of convergent validation of the instrument has a firm foothold in the developed corpus of findings that indicate that teachers who intend to transmit ready-made knowledge, and at the same time use the strategy of focusing on their own activities, encourage in students an approach to learning that is characterized by superficial processing of subject matter with short-term memorization as a consequence. On the other hand, teachers whose intention is to encourage conceptual change, and whose strategy is student-focused, promote an approach to learning in students that involves in-depth processing of subject content, which results in their understanding with wide possibilities of subsequent application (Prosser & Trigwell, 2014).

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## Appendix 1. Scatter Diagram

