

Validation of the Norwegian Versions of the Implementation Leadership Scale (ILS) and the Multifactor Leadership Questionnaire (MLQ) in a Mental Health Care Setting

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Research Article

Keywords: Evidence-based practice, Mental health, Implementation climate, Implementation strategies, PTSD, Transformational leadership, Implementation leadership

Posted Date: July 28th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-689201/v1>

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Version of Record: A version of this preprint was published at BMC Psychology on February 8th, 2022. See the published version at <https://doi.org/10.1186/s40359-022-00725-8>.

Abstract

Background: The implementation of evidence-based practices (EBPs) is of crucial importance in health care institutions and requires effective management from the leaders. However, there is a lack of sufficient assessment tools to evaluate the degree to which the employees' rate how well their leaders are at implementing EBPs. This emphasizes the need for a validated and widely used implementation scale for EBPs.

Methods: The current study evaluated the psychometric properties of the Multifactor Leadership Questionnaire (MLQ) and the Implementation Leadership Scale (ILS) in a Norwegian mental health care setting.

Results: Results from confirmatory factor analyses indicated that the MLQ and ILS were valid instruments for measuring general and implementation leadership. The scales demonstrated good convergent validity. In addition, attitudes towards EBPs did not seem to be associated with the ILS and the MLQ, further supporting the applicability of the instruments.

Conclusions: The two scales demonstrate good psychometric properties in a Norwegian mental health care setting, which suggests that the MLQ and ILS are valid and reliable tools for measuring leadership in an implementation setting. More research is highly needed to disentangle the link between perceived leadership and objective measures of successful implementation of EBPs.

Trial registration: NSD 690133, NSD 60059/3/OOS

Background

Effective leadership has been identified as an important factor associated with the successful implementation of evidence-based practices (EBPs) in mental health services (1–3). The focus on implementing EBPs in the healthcare system started in the 1990's (4). Over the years, it has subsequently been shown that successfully implementing EBPs may lead to better and more effective health care services, with lower costs, higher job satisfaction among clinicians, and higher patient satisfaction (5–7). Leaders are an important part of any implementation process, as they can influence the organizational climate at the workplace, cooperation between team members, and employee's attitudes towards the EBP (8–11). With the growing interest in the role that leadership plays in effective EBP implementation, there is a need for establishing reliable and valid measures to assess leadership behaviors that relate to successful implementation.

In the quest to discern the leader's role in the implementation of EBPs, there was initially a focus on identifying general leadership behaviors associated with different implementation outcomes (11, 12), using leadership concepts such as the Full-Range Leadership (FRL;13) theory. FRL is one of the most widely used leadership theories. It describes different leadership behaviors such as transformational leadership, in which leaders motivate and encourage employees; transactional leadership, where the

leader rewards and punishes employees based on performance; and non-leadership, where the leader has a more “hands off” approach and avoids making decisions (14, 15). Several studies have shown a relation between transformational leadership and different implementation outcomes, such as employees’ attitudes towards EBPs (16), motivation (17), turnover intention (18), burnout (19), and overall improved performance at all levels of the workplace (20–22).

The Multifactor Leadership Questionnaire (MLQ) is based on the FLR leadership theory, and is likely the most frequently used scale to measure leadership (23). The scale has been psychometrically validated several times, showing acceptable scores (ranging from $\alpha = .78 - .94$; 21–24). The MLQ has also previously been validated in a Norwegian sample (24), where each subscale showed adequate psychometric properties ($\alpha = .62 - .84$). However, the validations differ as a result of researchers altering the original factor structure by either combining or excluding certain factors or items (25, 28). The original structure consists of nine subscales, where *idealized influence* was separated into *behaviors* and *attributed charisma* (Bass & Riggio06). However, several researchers treat *idealized influence* as one factor (23, 25, 28), and the scale has accordingly been broadly used as an eight-factor scale, including *idealized influence*, *inspirational motivation*, *intellectual stimulation*, *individualized consideration*, *contingent reward*, *management-by-exception (active)*, *management-by-exception (passive)* and *laissez-faire*. However, although most use the eight- or nine-factor models (25, 30, 31), some have rearranged the subscales into categories different from what was originally proposed (i.e. two subscales measuring non-leadership; (26, 32)). These alterations could cause misunderstandings when using the MLQ in relation to implementation outcomes. The creators of the scale have recommended to analyze each of the eight subscales of the MLQ individually, with the exception of the subscales of transformational leadership, which can be combined (33). The current paper therefore considers the MLQ as consisting of eight subscales: four subscales measuring transformational leadership, three subscales measuring transactional leadership and one measuring non-leadership.

While the interest in the relationship between these more general leadership concepts and successful EBP implementation was growing, research on strategic leadership behaviors related to implementation was lacking. Building on the growing evidence base that general leadership behaviors relates to effective EBP implementation, scientists have turned their interest towards specific leadership behaviors that may be more proximally related to successful EBP implementation. Newer research have established that such specific, or often termed strategic leadership behaviors, may provide additional explanatory value in the investigation into how leadership relates to key implementation outcomes (8, 34, 35).

The focus on identifying strategic leadership behaviors for implementation coincides with a more general call within the implementation research field to develop simple, brief and psychometrically sound implementation measures (36, 37). In 2014, Aarons, Ehrhart and Farahnak developed the *Implementation Leadership Scale* (ILS), drawing from a broad base of theory and research on implementation, leadership, and organizational climate (11). Results from studies investigating the effect of strategic leadership behaviors (i.e. implementation leadership) have revealed that these promote organizational change (12).

This is consistent with findings reporting that employee-ratings on the ILS are correlated with factors considered to be important during the implementation of EBPs and their sustainment (38).

The ILS was initially developed in the U.S., and has been validated several times (39–41). The ILS has shown excellent psychometric properties in investigations using both employee-ratings and leader self-ratings, and in multiple sectors (42–46). The ILS contains four subscales, including *proactive leadership*, *knowledgeable leadership*, *supportive leadership* and *perseverant leadership*, and the suggested four-factor structure has been confirmed in all studies (5, 11, 39, 46). Analysis of reliability have found internal consistency to be excellent (Cronbach's α ranging from .92 – .98) (42, 44, 46). Convergent validity has been investigated by correlating the ILS with the MLQ, finding moderate to high correlations (Pearson's correlation ranging from .63 to .75) between the two leadership concepts (11). Discriminant validity has been established by correlating the ILS to theoretically unrelated implementation concepts, such as the Evidence-based Practice Attitude Scale (EBPAS), finding zero to low correlations (Pearson's correlations ranging from .05 to .4) (11).

Only two articles have investigated the psychometric properties of the ILS outside the U.S. – in China and in Greece (5, 47). Employee ratings have previously been used when investigating the psychometric properties in a U.S. context, and a similar investigation in a Norwegian context would provide further evidence for the relevance of the concept of implementation leadership.

The purpose of this study is to examine the psychometric properties of the Norwegian version of the MLQ and the ILS. First, the factor structure and internal consistencies of the two scales will be explored. Secondly, we will examine the convergent and divergent validity of the MLQ and the ILS. Based on previous findings regarding the ILS, we expect to find support for a four-factor model and high internal consistency for the total scale and all subscales. In addition, we anticipate that the ILS will have moderate to high correlations with the MLQ and subsequently low correlations with the EBPAS. In accordance with other studies, we expect to find support for an eight-factor model (48, 49), as well as similar results regarding convergent and divergent validity as hypothesized above.

Method

Procedure

The study took place as part of a national implementation of evidence-based treatment for post-traumatic stress disorder (PTSD) in Norwegian specialized mental health care clinics for adults (N =25) and youth (N =22) (50). The data was collected in the context of the utilization of the Leadership and Organizational Change for Implementation (LOCI) as an implementation strategy (50,51). Local health trusts were contacted via e-mail with an invitation to participate in the implementation project and research study. Participating clinics were included in the hybrid type II project (52) based on motivation and availability. Data was collected between 2018 and 2020. Participation was voluntary and informed consent was attained from all participants in the study.

Participants

Participants were 804 therapists working at child or adult mental health clinics in Norway. The final sample size was 795 after removing missing data. Close to half (46.2%) of the participants were psychologists, 75% were females, and the average age was 43.9 years. Participants rated their leaders (N = 47). The average age for leaders was 49.7, and 55% had a background in psychology (Table 1).

Table 1 Participant Demographics

| | Therapists (N=795) | Leaders (N=47) |
|----------------------------------|-----------------------|-------------------|
| Gender | | |
| Male | 169 (22.5%) | 18 (38.3%) |
| Female | 599 (75.3%) | 29 (61.7%) |
| Age | | |
| Mean (SD) | 43.8 (11.1) | 49.7 (7.64) |
| Missing | 114 (14.3%) | 0 (0%) |
| Education | | |
| Medicine | 148 (18.6%) | 5 (10.6%) |
| Psychology | 367 (46.2%) | 26 (55.3%) |
| Nurse | 53 (6.7%) | 8 (17.0%) |
| Social work | 60 (7.5%) | 8 (17.0%) |
| Other | 89 (11.2%) | 0 (0%) |
| Missing | 78 (9.8%) | 0 (0%) |
| Years in current position | | |
| Mean (SD) | 11.8 (9.56) | 21.5 (18.3) |
| Missing | 192 (24.2%) | 0 (0%) |

Measures

Implementation Leadership Scale (ILS) (42)

ILS is a 12-item measure addressing leadership support for the usage of EBP. It covers four different implementation leadership dimensions. *Proactive Leadership*, which describes the degree to which the leader anticipates and addresses implementation challenges, *Knowledgeable Leadership* refers to the degree to which a leader has a deep understanding of EBP and implementation issues, *Supportive Leadership* measures the degree of the leader's support of followers' adoption and use of EBP, and *Perseverant Leadership* refers to the degree to which the leader is consistent, unwavering, and responsive to EBP implementation. It is scored from 0 (not at all) to 4 (to a very great extent). The total ILS score is created by computing the mean of the four subscales. ILS was translated to Norwegian by an independent research group at the Regional Center for Children and Adolescent Mental Health (RBUP). The third and fourth author completed an additional back-translation. Both the initial translation and back-translation were done in close collaboration with the developers of the scale. There were only small differences between the two translations, and minor adjustments were done to align the translations.

Multifactor Leadership Questionnaire (MLQ) (53)

The MLQ is a 36-item questionnaire, measuring transformational, transactional, and non-leadership. Transformational leadership consists of four subscales. *Inspirational Motivation* measures how positive and motivated the leader is about the future, which may influence the employees' feelings of motivation. *Idealized Influence* focuses on the leaders' attributes, like perceived power, values and ideals, and underlines a collective sense of these mission and values (25). *Intellectual Stimulation* refers to whether the leader introduces new methods of viewing issues and seeks different perspectives. Lastly, *Individualized Consideration* measures how well the leader considers individual needs and helps the employees develop their strengths.

Transactional leadership consists of three subscales. *Contingent Reward* is a leadership behavior that focuses on clear, defined requirements, and rewards desired outcomes through economical or emotional advantages. In both *Management-by-exception active and passive*, the leader provides corrective action when they notice behaviors that deviate from the norm. In the active subscale, the leader actively monitors actions and intervenes before the deviations start occurring, while in the passive, the leader waits until the deviations have occurred (54). Lastly, non-leadership is measured by *Laissez-faire*, which assesses the absence of leadership. The MLQ is scored from 0 (Not at all) to 4 (Frequently, if not always). A Norwegian translation was used in the current study (24).

Evidence-based Practice Attitude Scale (EBPAS) (55)

The EBPAS is a 15-item scale measuring mental health providers' attitudes toward adoption of evidence-based practices. The scale has four subscales: *Appeal*, which describes the intuitive appeal of the practice, *Openness*, referring to openness to new practices, *Requirement*, the likelihood of adopting the EBP if required to do so, and *Divergence*, which refers to the perceived divergence of the new practice from usual practice. The EBPAS is scored on a 5-point Likert scale ranging from 0 (Not at all) to 4 (To a

very great extent). The overall score is calculated by reversing the scores on the divergent subscale, and then averaging the items from all scales. A Norwegian translation was used in the current study (56). The scale has shown adequate psychometric properties in a Norwegian sample of therapists working at mental health care services ($\alpha = .86$; (56), $\alpha = .81$; (57), and similar properties were found in the current study (15-items; $\alpha = 0.87$, CI (95% bootstrapping based on 1000 samples) = 0.853– 0.884).

Statistical Analyses

Internal consistency was assessed by examining Cronbach's alpha for all subscales and the total scale (Table 2).

Confirmatory Factor Analysis

Confirmatory factor analysis was conducted using MPlus 8.3 (58). Fit indices (standardized root mean square residual=SRMR, root mean-square error of approximation= RMSEA, comparative fit index=CFI and Tucker-Lewis index=TLI) were used as indicators of validity. We used recommended cut-offs that indicate a good fit for validation: CFI & TLI $\geq .90$, SRMR $<.08$, RMSEA $<.08$ (59,60). The CFA was conducted using the weighted least square mean and variance estimation (WLSMV), which is ideal for categorical data. As clinicians working in the same clinic had the same leader, we controlled for the multilevel, nested data structure.

Convergent and Discriminant Validity

Discriminant and convergent validity were subsequently calculated by correlation analyses. To assess convergent validity, the MLQ and ILS were compared to each other. Divergent validity was measured by viewing the correlations between both of the aforementioned scales to the EBPAS subscale scores. This was done by using employee-ratings (clinicians working with patients) in specialized Norwegian mental health care services. The analyses were conducted using IBM SPSS Statistics for Windows, V.26 (61) and Rstudio (62)

Results

Reliability

The internal consistency of the ILS total scale ($\alpha = .96$), and the four factors were excellent (ranging from $\alpha = .93 - .97$; see Table 2). The internal consistency of Transformational leadership was also excellent ($\alpha = .96$). Individualized Consideration ($a = 0.86$), Intellectual Stimulation ($a = 0.91$), Inspirational Motivation ($a = 0.84$), Idealized Influence ($a = 0.92$), Contingent Reward ($a = 0.86$), Management-by-Exception Active

($a = 0.89$), Management-by-Exception Passive ($a = 0.85$), and Laissez-faire ($a = 0.88$), showed acceptable internal consistency.

Table 2

Summary statistics for the ILS total scale, subscales, and scale items and the MLQ subscales and scale items

| ILS and MLQ | Mean | SD | <i>a</i> |
|--|-------------|--------------|-----------------|
| Implementation Leadership Subscales | | | |
| Proactive Leadership | 2.05 | 1.01 | .93 |
| 1. Developed a plan to facilitate EBP implementation | 2.14 | 1.09 | |
| 2. Removed obstacles to implementation of EBP | 2.02 | 1.07 | |
| 3. Established clear standards for implementation of EBP | 1.99 | 1.09 | |
| Knowledgeable Leadership | 2.21 | 1.10 | .97 |
| 4. Is knowledgeable about EBP | 2.20 | 1.13 | |
| 5. Is able to answer staff questions about EBP | 2.16 | 1.16 | |
| 6. Knows what he/she is taking about when it comes to EBP | 2.26 | 1.13 | |
| Supportive Leadership | 2.81 | 0.961 | .96 |
| 7. Supports employee efforts to learn more about EBP | 2.74 | 1.01 | |
| 8. Recognizes and appreciates employee efforts | 2.85 | 0.996 | |
| 9. Supports employee efforts to use EBP | 2.83 | 1.00 | |
| Perseverant Leadership | 2.49 | 0.960 | .95 |
| 10. Perseveres through the ups and downs of implementing | 2.51 | 1.00 | |
| 11. Carries on through the challenges of implementing EBP | 2.56 | 0.975 | |
| 12. Reacts to critical issues regarding implementation of EBP | 2.41 | 1.05 | |
| ILS total (12 items) | 2.39 | 0.884 | .96 |
| Multifactor Leadership Questionnaire | | | |
| Individualized Consideration | 2.62 | 0.869 | .86 |
| 1. Spends time teaching and coaching | 2.19 | 1.05 | |
| 2. Treats you as an individual rather than just a member of the group | 3.12 | 0.973 | |
| 3. Considers that you have different needs, abilities, and aspirations from others | 2.73 | 1.03 | |
| 4. Helps you develop your strengths | 2.45 | 1.09 | |
| Intellectual Stimulation | 2.60 | 0.870 | .91 |
| 5. Re-examines critical assumptions to question whether they are appropriate | 2.49 | 1.03 | |

| ILS and MLQ | Mean | SD | <i>a</i> |
|--|-------------|--------------|-----------------|
| 6. Seeks differing perspectives when solving problems | 2.83 | 0.941 | |
| 7. Gets you to look at problems from many different angles | 2.51 | 0.992 | |
| 8. Suggests new ways of looking at how to complete assignments | 2.58 | 0.954 | |
| Inspirational Motivation | 2.76 | 0.785 | .84 |
| 9. Talks optimistically about the future | 2.99 | 0.940 | |
| 10. Talks enthusiastically about what needs to be accomplished | 2.85 | 1.00 | |
| 11. Articulates a compelling vision of the future | 2.29 | 0.981 | |
| 12. Expresses confidence that goals will be achieved | 2.89 | 0.877 | |
| Idealized Influence | 2.72 | 0.812 | .92 |
| 13. Instills pride in you for being associated with him/her | 2.43 | 1.13 | |
| 14. Goes beyond self-interest for the good of the group | 2.88 | 0.945 | |
| 15. Act in ways that builds your respect | 2.99 | 0.996 | |
| 16. Displays a sense of power and confidence | 2.90 | 1.03 | |
| 17. Talks about his/her most important values and beliefs | 2.41 | 1.02 | |
| 18. Specifies the importance of having a strong sense of purpose | 2.53 | 0.986 | |
| 19. Considers the moral and ethical consequences of decisions | 2.78 | 0.999 | |
| 20. Emphasizes the importance of having a collective sense of mission | 2.82 | 0.919 | |
| Transformational Leadership total | 2.69 | 0.754 | .96 |
| Contingent Reward | 2.45 | 0.870 | .86 |
| 21. Provides assistance in exchange for your efforts | 2.80 | 1.06 | |
| 22. Discusses in specific terms who is responsible for achieving performance targets | 2.19 | 1.05 | |
| 23. Makes it clear what you can expect to receive when performance goals are achieved | 1.97 | 1.09 | |
| 24. Expresses satisfaction when you meet expectations | 2.81 | 0.952 | |
| Management by exception active | 1.73 | 0.957 | .89 |
| 25. Focuses attention on irregularities, mistakes, exceptions, and deviations | 1.89 | 1.01 | |
| 26. Concentrates his/her full attention on dealing with mistakes, complaints, and failures | 1.53 | 1.18 | |

| ILS and MLQ | Mean | SD | <i>a</i> |
|--|--------------|--------------|------------|
| 27. Keeps track of all mistakes | 1.67 | 1.15 | |
| 28. Directs your attention to failures to meet standards | 1.85 | 1.07 | |
| Management by exception passive | 0.816 | 0.821 | .85 |
| 29. Fails to interfere until problems become serious | 0.900 | 1.02 | |
| 30. Waits for things to go wrong before taking action | 0.676 | 0.933 | |
| 31. Shows that he/she is a firm believer in "If it ain't broke don't fix it" | 1.08 | 1.06 | |
| 32. Demonstrates that problems must become chronic before taking action | 0.607 | 0.920 | |
| Laissez-Faire | 0.664 | 0.780 | .88 |
| 33. Avoids getting involved when importance issues arise | 0.496 | 0.831 | |
| 34. Is absent when needed | 0.838 | 0.981 | |
| 35. Avoids making decisions | 0.681 | 0.919 | |
| 36. Delays responding to urgent questions | 0.644 | 0.905 | |

Confirmatory Factor Analysis

Implementation Leadership Scale

As each subscale of the ILS is considered an indicator of overall implementation leadership, a higher order model was considered. The higher order CFA model demonstrated excellent fit ($\chi^2(48) = 112.575, p < 0.001$; CFI = 0.999, TLI = 0.999; RMSEA = 0.043; SRMR = 0.010). Standardized factor loadings are displayed in Fig. 1, and all factor loadings were significant (p 's < 0.001). Nested data was controlled for, and were grouped by leaders. (See Fig. 1).

Multifactor Leadership Questionnaire

The eight-factor model also showed excellent fit ($\chi^2(566) = 1891.317, p < 0.001$; CFI = 0.968, TLI = 0.964; RMSEA = 0.056; SRMR = 0.050). Nested data was controlled for. (See Fig. 2).

Convergent and Discriminant Validity

The ILS subscales had moderate to high correlations with the score of the MLQ Transformational Leadership subscale and the Contingent Reward subscale, which is consistent with previous findings (11). Correlations ranged from .49 to .57, as shown in Fig. 3. As predicted, the ILS and the MLQ both had low correlations with the EBPAS subscales, with correlations ranging from $-.17$ to $.23$. (See Fig. 3)

Discussion

The aim of the current study was to investigate the psychometric properties of the Multifactor Leadership Questionnaire and the Implementation Leadership Scale in a Norwegian clinical mental health care setting. Both general leadership (11) and implementation leadership (11) have shown to be important for facilitating successful implementation. Results from the confirmatory factor analyses showed an excellent fit, supporting an eight-factor model for the MLQ, and a four-factor model for the ILS. Regarding the ILS, the internal consistency was excellent for the total scale and for the subscales. Results from the correlations indicate strong support for both convergent validity in regard to MLQ transformational leadership and discriminant validity in regard to EBPAS. Consistent with previous studies (11), the moderate to high correlations with the MLQ transformational leadership indicate that similar constructs are measured in both of the two scales, but not so similar that they would be considered identical. This suggests that the two scales can be used together to get an overall picture of behaviors important for effective implementation of EBPs. Furthermore, the low correlations between the EBPAS and the ILS, and the EBPAS and the MLQ support the hypothesis that they measure theoretically different constructs, which is in line with previous studies (63).

Research on the MLQ has varied in that researchers occasionally combine different subscales into one factor (28, 64), instead of assessing the subscales individually as done in the current paper and according to recommendations from the developers of the scale ((33)). Due to the acceptable values regarding internal consistency and expected results regarding convergent and discriminant validity, the findings indicate that the original eight-factor structure can be maintained. Furthermore, results indicate that each of the subscales constituting the scale measure different constructs within general leadership.

With measures such as the ILS and the MLQ, we are able to assertively measure leadership behaviours assumed to be needed to successfully implement changes that consequently improve patients' well-being. Moreover, the validation of the MLQ is novel in regard to the factor structure. The previous validation in a Norwegian sample found a three-factor structure consisting of several subscales in each factor (24), while we found support for each subscale as individual factors. Bass and Riggio (2006) suggested that the inconsistent findings regarding the MLQ subscales may occur due to heterogeneous samples of leaders from different cultural and professional backgrounds (30, 33). The current sample is a quite homogenous group, consisting of Norwegian mental health service practitioners, mostly women aged 44. This supports previous findings regarding the individual factors of the MLQ (30). Furthermore, findings from the current study adds to the literature regarding leadership and implementation of EBPs by including results from a Nordic sample. Overall, investigations into the psychometric properties of scales frequently used for measuring key implementation concepts, such as in this study, lays the foundation for gaining valid knowledge on the complex process of successfully implementing EBPs.

The current study had a large sample size, spread across 43 clinics throughout the country. This variety is a clear strength, as it increases generalisability. A limitation of the current study was that data was only collected from participants in mental health clinics. We encourage future studies to investigate the psychometric properties of these scales in other sectors, and between different professions within these sectors. Although results suggest that high scores on the transformational leadership and contingent

reward subscales are positively correlated to factors of implementation leadership, it has not yet been established whether these leaders actually have been successful at implementing EBPs.

Conclusion

As research has established leadership as an important factor for successful implementation, there is a need for efficient measures that assess both general and strategic leadership behaviors. The current study demonstrated that the Norwegian versions of the *Multifactor Leadership Questionnaire* and the *Implementation Leadership Scale* scales are valid and reliable instruments for measuring general leadership and leadership in the context of EBP implementation, respectively. Results showed that the subscales of transformational leadership and contingent reward correlated with all subscales of the ILS. Divergent validity analysis showed that the EBPAS is a theoretically different construct compared to the MLQ and the ILS. More research is needed to further understand how different leadership behaviors, both general and strategic, relate to successful implementation of EBPs.

List Of Abbreviations

EBP

Evidence-based practice

ILS

Implementation Leadership Scale

MLQ

Multifactor Leadership Questionnaire

EBPAS

Evidence-based Practice Attitudes Scale

PTSD

Post-traumatic stress disorder

Declarations

Ethics approval and consent to participate

The current study is approved by the Norwegian Centre for Research Data (NSD). All participants consented to participating in the study. All parts of the study were conducted in compliance with the Helsinki Declaration.

Consent for publication

Not applicable.

Availability of data and materials

The dataset used in the current study is available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests

Funding

The current study is part of a national implementation of EBPs for post-traumatic stress disorder (PTSD) in Norwegian specialized mental health clinics for children and adults. The implementation project was funded by the Norwegian Ministry of Health and Care Services. The funders had no part in any aspect of the project, neither the study design, data collection, analysis, nor in writing the manuscript.

Authors' contributions

KME and AMSS were principal investigators and contributed in the translation of the measurement instruments. NB developed the manuscript outline, conducted the data analysis, and drafted the manuscript. EHL contributed to the background and discussion section of the manuscript. All authors were involved in editing and reviewing the manuscript. All authors read and approved the final manuscript.

Acknowledgements

Not applicable.

References

1. Birken S, Lee S-Y, Weiner B. Uncovering middle managers' role in healthcare innovation implementation. Vol. 7. 2012. 28 p.
2. Edbrooke-Childs J, Calderon A, McDonnell M, Hirvonen H, Deighton J, Wolpert M. A qualitative exploration of the role of leadership in service transformation in child and adolescent mental health services. *Child Adolesc Ment Health*. 2018;
3. Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. Diffusion of innovations in service organizations: systematic review and recommendations. *Milbank Q*. 2004;82(4):581–629.
4. Bhargava K, Bhargava D. Evidence Based Health Care: A scientific approach to health care. *Sultan Qaboos Univ Med J*. 2007 Aug;7(2):105–7.
5. Mandrou E, Tsounis A, Sarafis P. Validity and reliability of the Greek version of Implementation Leadership Scale (ILS). *BMC Psychol*. 2020 May 14;8(1):49.
6. Melnyk BM, Fineout-Overholt E, Gallagher-Ford L, Kaplan L. The state of evidence-based practice in US nurses: critical implications for nurse leaders and educators. *J Nurs Adm*. 2012 Sep;42(9):410–7.

7. Bodenheimer T, Sinsky C. From triple to quadruple aim: care of the patient requires care of the provider. *Ann Fam Med*. 2014 Dec;12(6):573–6.
8. Hong Y, Liao H, Hu J, Jiang K. Missing link in the service profit chain: a meta-analytic review of the antecedents, consequences, and moderators of service climate. *J Appl Psychol*. 2013 Mar;98(2):237–67.
9. Scott SG, Bruce RA. Determinants of Innovative Behavior: A Path Model of Individual Innovation in the Workplace. *Acad Manage J*. 1994;37(3):580–607.
10. Gumusluoglu L, Ilsev A. Transformational leadership, creativity, and organizational innovation. *J Bus Res*. 2009 Apr 1;62(4):461–73.
11. Aarons GA, Ehrhart MG, Farahnak LR. The Implementation Leadership Scale (ILS): development of a brief measure of unit level implementation leadership. *Implement Sci IS*. 2014 Apr 14;9(1):45.
12. Hong Y, Liao H, Hu J, Jiang K. Missing Link in the Service Profit Chain: A Meta-Analytic Review of the Antecedents, Consequences, and Moderators of Service Climate. *J Appl Psychol*. 2013 Mar 1;98:237–67.
13. Burns, J.M. *Leadership*. New York: Harper and Row; 1978.
14. Bass BM. From transactional to transformational leadership: Learning to share the vision. *Organ Dyn*. 1990;18(3):19–31.
15. Bass BM, Avolio BJ, Jung DI, Berson Y. Predicting unit performance by assessing transformational and transactional leadership. *J Appl Psychol*. 2003;88(2):207.
16. Farahnak LR, Ehrhart MG, Torres EM, Aarons GA. The Influence of Transformational Leadership and Leader Attitudes on Subordinate Attitudes and Implementation Success. *J Leadersh Organ Stud*. 2020 Feb 1;27(1):98–111.
17. Fernet C, Trépanier S-G, Austin S, Gagné M, Forest J. Transformational leadership and optimal functioning at work: On the mediating role of employees' perceived job characteristics and motivation. *Work Stress*. 2015 Jan 2;29(1):11–31.
18. Bycio P, Hackett, R. D., Allen, J. S. Further assessments of Bass's (1985) conceptualization of transactional and transformational leadership. *J Appl Psychol*. 1995;80(4):468–78.
19. Corrigan PW, Diwan S, Champion J, Rashid F. Transformational Leadership and the Mental Health Team. *Adm Policy Ment Health Ment Health Serv Res*. 2002 Nov 1;30(2):97–108.
20. Zohar D. Modifying supervisory practices to improve subunit safety: A leadership-based intervention model. *J Appl Psychol*. 2002;87(1):156.
21. Hater JJ, Bass BM. Superiors' evaluations and subordinates' perceptions of transformational and transactional leadership. *J Appl Psychol*. 1988;73(4):695–702.
22. Howell JM, Avolio BJ. Transformational leadership, transactional leadership, locus of control, and support for innovation: Key predictors of consolidated-business-unit performance. *J Appl Psychol*. 1993;78(6):891–902.

23. Toor S-R, Ofori G. Ethical Leadership: Examining the Relationships with Full Range Leadership Model, Employee Outcomes, and Organizational Culture. *J Bus Ethics*. 2009 Mar 26;90(4):533.
24. Hetland H, Sandal G. Transformational leadership in Norway: Outcomes and personality correlates. *Eur J Work Organ Psychol*. 2003 Jun 1;12(2):147–70.
25. Tejeda MJ, Scandura TA, Pillai R. The MLQ revisited: psychometric properties and recommendations. *Leadersh Q*. 2001 Mar 1;12(1):31–52.
26. Moreno-Casado H, Leo FM, López-Gajardo MA, García-Calvo T, Cuevas R, Sánchez-Oliva D. Adaptation and validation of the MLQ-5X Leadership Scale to the Spanish educational context. *An Psicol*. 2021 Sep;37(2):311–22.
27. Boamah SA, Tremblay P. Examining the Factor Structure of the MLQ Transactional and Transformational Leadership Dimensions in Nursing Context. *West J Nurs Res*. 2019 May 1;41(5):743–61.
28. Kanste O, Miettunen J, Kyngäs H. Psychometric properties of the Multifactor Leadership Questionnaire among nurses. *J Adv Nurs*. 2007;57(2):201–12.
29. Stadnick NA, Meza RD, Suhrheinrich J, Aarons GA, Brookman-Frazee L, Lyon AR, et al. Leadership profiles associated with the implementation of behavioral health evidence-based practices for autism spectrum disorder in schools. *Autism*. 2019 Nov 1;23(8):1957–68.
30. Antonakis J, Avolio BJ, Sivasubramaniam N. Context and leadership: an examination of the nine-factor full-range leadership theory using the Multifactor Leadership Questionnaire. *Leadersh Q*. 2003 Jun 1;14(3):261–95.
31. Muenjohn N, Armstrong P. Evaluating the structural validity of the Multifactor Leadership Questionnaire (MLQ), capturing the leadership factors of transformational-transactional leadership. *Contemp Manag Res*. 2008 Apr 9;4:3–14.
32. Oliver Serrat. *Leading Solutions*. The Chicago School of Professional Psychology, USA: Springer; 2021. 353 p.
33. Bass, Bernard M., Riggio, Ronald E. *Transformational leadership*. 2006.
34. Kelloway EK, Mullen J, Francis L. Divergent effects of transformational and passive leadership on employee safety. *J Occup Health Psychol*. 2006;11(1):76–86.
35. Powell BJ, Mandell DS, Hadley TR, Rubin RM, Evans AC, Hurford MO, et al. Are general and strategic measures of organizational context and leadership associated with knowledge and attitudes toward evidence-based practices in public behavioral health settings? A cross-sectional observational study. *Implement Sci*. 2017 May 12;12(1):64.
36. Martinez RG, Lewis CC, Weiner BJ. Instrumentation issues in implementation science. *Implement Sci*. 2014;9(1):118.
37. Proctor EK, Landsverk J, Aarons G, Chambers D, Glisson C, Mittman B. Implementation research in mental health services: an emerging science with conceptual, methodological, and training challenges. *Adm Policy Ment Health*. 2009 Jan;36(1):24–34.

38. Aarons GA, Ehrhart MG, Torres EM, Finn NK, Beidas RS. The Humble Leader: Association of Discrepancies in Leader and Follower Ratings of Implementation Leadership With Organizational Climate in Mental Health. *Psychiatr Serv.* 2016 Oct 3;68(2):115–22.
39. Finn NK, Torres EM, Ehrhart MG, Roesch SC, Aarons GA. Cross-Validation of the Implementation Leadership Scale (ILS) in Child Welfare Service Organizations. *Child Maltreat.* 2016 Aug 1;21(3):250–5.
40. Lyon AR, Cook CR, Brown EC, Locke J, Davis C, Ehrhart M, et al. Assessing organizational implementation context in the education sector: confirmatory factor analysis of measures of implementation leadership, climate, and citizenship. *Implement Sci.* 2018 Jan 8;13(1):5.
41. Torres EM, Ehrhart MG, Beidas RS, Farahnak LR, Finn NK, Aarons GA. Validation of the Implementation Leadership Scale (ILS) with Supervisors' Self-Ratings. *Community Ment Health J.* 2018 Jan;54(1):49–53.
42. Aarons GA, Ehrhart MG, Farahnak LR. The Implementation Leadership Scale (ILS): development of a brief measure of unit level implementation leadership. *Implement Sci.* 2014;9(1):45.
43. Aarons GA, Ehrhart MG, Farahnak LR, Finn N. Implementation leadership: Confirmatory factor analysis and supervisor-clinician discrepancy in ratings on the Implementation Leadership Scale (ILS). *Implement Sci.* 2015 Aug 14;10(1):A70.
44. Finn NK, Torres EM, Ehrhart MG, Roesch SC, Aarons GA. Cross-validation of the implementation leadership scale (ILS) in child welfare service organizations. *Child Maltreat [Internet].* 2016;21. Available from: <https://doi.org/10.1177/1077559516638768>
45. Lyon AR, Cook CR, Brown EC, Locke J, Davis C, Ehrhart M. Assessing organizational implementation context in the education sector: confirmatory factor analysis of measures of implementation leadership, climate, and citizenship. *Implement Sci [Internet].* 2018;13. Available from: <https://doi.org/10.1186/s13012-017-0705-6>
46. Torres EM, Ehrhart MG, Beidas RS, Farahnak LR, Finn NK, Aarons GA. Validation of the Implementation Leadership Scale (ILS) with supervisors' self-ratings. *Community Ment Health J.* 2018;54(1):49–53.
47. Hu J, Hu J. Translation and Validation of the Implementation Leadership Scale in Chinese Nursing Context. In STTI; 2019 [cited 2021 Feb 4]. Available from: <https://stti.confex.com/stti/congrs19/webprogram/Paper94783.html>
48. Hemsworth D, Muterera J, Baregheh A. Examining Bass's Transformational Leadership In Public Sector Executives: A Psychometric Properties Review. *J Appl Bus Res.* 2013 Apr 23;29:853–62.
49. Xu L, Wubbena Z, Stewart T. Measurement invariance of second-order factor model of the Multifactor Leadership Questionnaire (MLQ) across K-12 principal gender. *J Educ Adm.* 2016 Jan 1;54(6):727–48.
50. Egeland KM, Skar A-MS, Endsjø M, Laukvik EH, Bækkelund H, Babaii A, et al. Testing the leadership and organizational change for implementation (LOCI) intervention in Norwegian mental health clinics: a stepped-wedge cluster randomized design study protocol. 2019 Mar 13;14(1):28.

51. Aarons GA, Ehrhart MG, Farahnak LR, Hurlburt MS. Leadership and organizational change for implementation (LOCI): a randomized mixed method pilot study of a leadership and organization development intervention for evidence-based practice implementation. *Implement Sci* [Internet]. 2015;10. Available from: <https://doi.org/10.1186/s13012-014-0192-y>
52. Curran GM, Bauer M, Mittman B, Pyne JM, Stetler C. Effectiveness-implementation Hybrid Designs. *Med Care*. 2012 Mar;50(3):217–26.
53. Bass BM, Avolio BJ. *MLQ: Multifactor Leadership Questionnaire*. Redwood City: Mind Garden; 1995.
54. Puni A, Mohammed I, Asamoah E. Transformational leadership and job satisfaction: the moderating effect of contingent reward. *Leadersh Organ Dev J*. 2018 Jan 1;39(4):522–37.
55. Aarons GA. Mental Health Provider Attitudes Toward Adoption of Evidence-Based Practice: The Evidence-Based Practice Attitude Scale (EBPAS). *Ment Health Serv Res*. 2004;6(2):61–74.
56. Rye M, Torres EM, Friborg O, Skre I, Aarons GA. The Evidence-based Practice Attitude Scale-36 (EBPAS-36): a brief and pragmatic measure of attitudes to evidence-based practice validated in US and Norwegian samples. *Implement Sci*. 2017 Apr 4;12(1):44.
57. Egeland K, Ruud T, Ogden T, Lindstrøm J, Heiervang K. Psychometric properties of the Norwegian version of the Evidence-Based Practice Attitude Scale (EBPAS): To measure implementation readiness. *Health Res Policy Syst*. 2016 Jun 17;14.
58. Muthén LK, Muthén BO. *Mplus User's Guide* [Internet]. *Mplus User's Guide* (Eighth ed.). 1998 [cited 2021 May 6]. Available from: https://www.statmodel.com/html_ug.shtml
59. Hair JF, Black, William C., Babin BJ, Anderson RE. *Multivariate Data Analysis* [Internet]. 7th ed. Pearson; 2013 [cited 2021 May 6]. Available from: <https://www.pearson.com/uk/educators/higher-education-educators/program/Hair-Multivariate-Data-Analysis-Pearson-New-International-Edition-7th-Edition/PGM1052102.html>
60. Kline RB. *Principles and practice of structural equation modeling*, 2nd ed. New York, NY, US: Guilford Press; 2005. xviii, 366 p. (*Principles and practice of structural equation modeling*, 2nd ed).
61. IBM Corp. *IBM SPSS Statistics for Windows*. Version 27.0. 2020.
62. RStudio Team. *RStudio: Integrated Development Environment for R* [Internet]. Boston, MA: RStudio, PBC.; 2020. Available from: <http://www.rstudio.com/>
63. Aarons GA, Ehrhart M, Farahnak LR. The implementation leadership scale (ILS): development of a brief measure of unit level implementation leadership. *Implement Sci*. 2014 Apr 14;9(1):45.
64. Edwards G, Schyns B, Gill R, Higgs M. The MLQ factor structure in a UK context. *Leadersh Organ Dev J*. 2012 Jan 1;33(4):369–82.

Figures

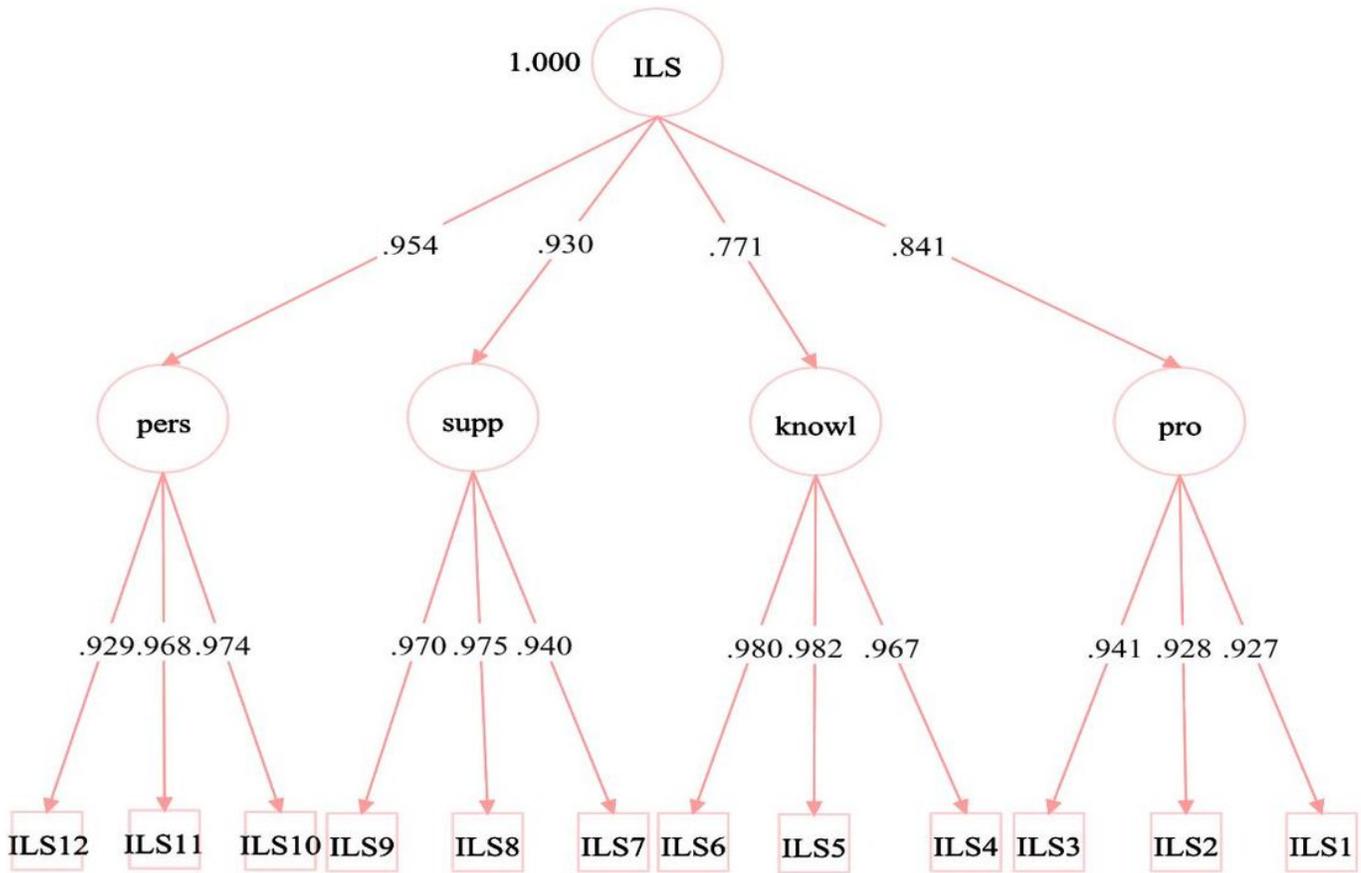


Figure 1

Standardized factor loadings for the ILS. The parameters are presented as standardized path coefficients. The circular shapes represent the factors, or subscales. The square boxes below represent the items. Arrows pointing from the factors to the items are the first-order factor loadings. Arrows from the latent construct (ILS) to the subscales are the second-order factor loadings. Pers = Perseverant, Supp = Supportive, Knowl = Knowledgeable, Pro = Proactive.

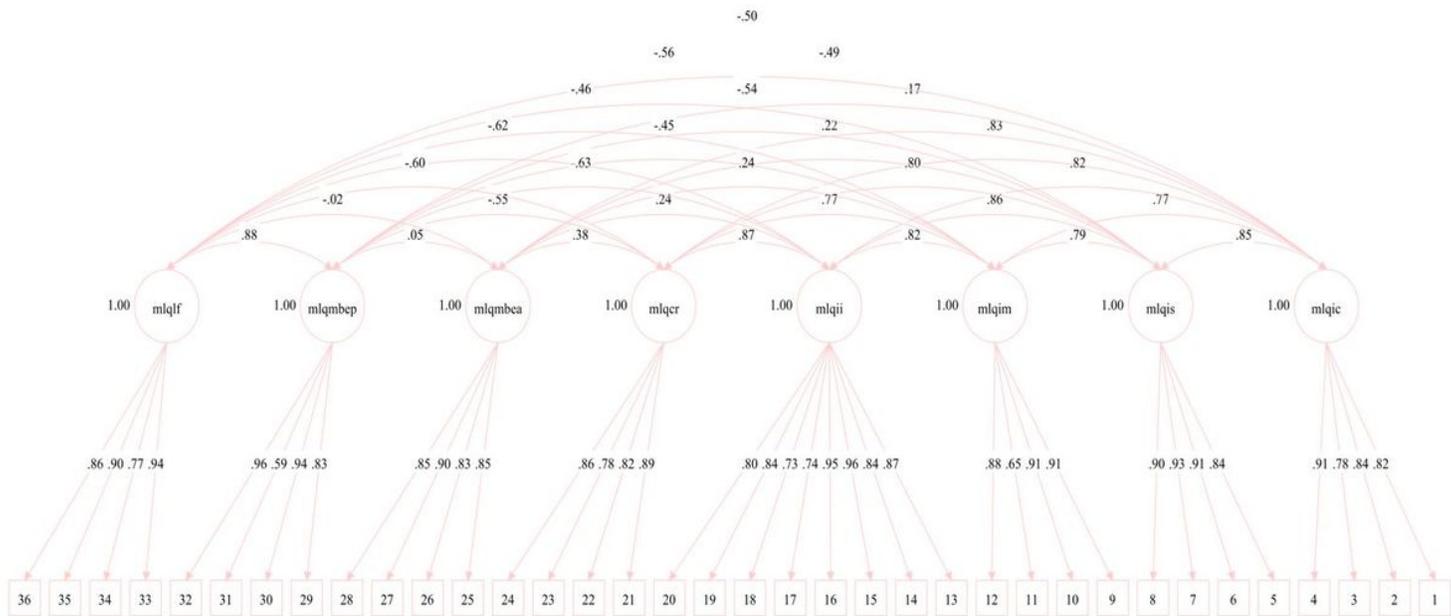


Figure 2

Standardized factor loadings for the MLQ - The parameters are presented as standardized path coefficients. The circular shapes represent the factors, or subscales. The square boxes below represent the items. Arrows pointing from the factors to the items are the factor loadings. mlqlf= Laissez-faire, mlqmbep = Management-by-exception passive, mlqmbea = Management-by-exception active, mlqcr = Contingent Reward, mlqii = Idealized Influence, mlqim = Inspirational Motivation, mlqis = Intellectual Stimulation, mlqic = Individualized Consideration.

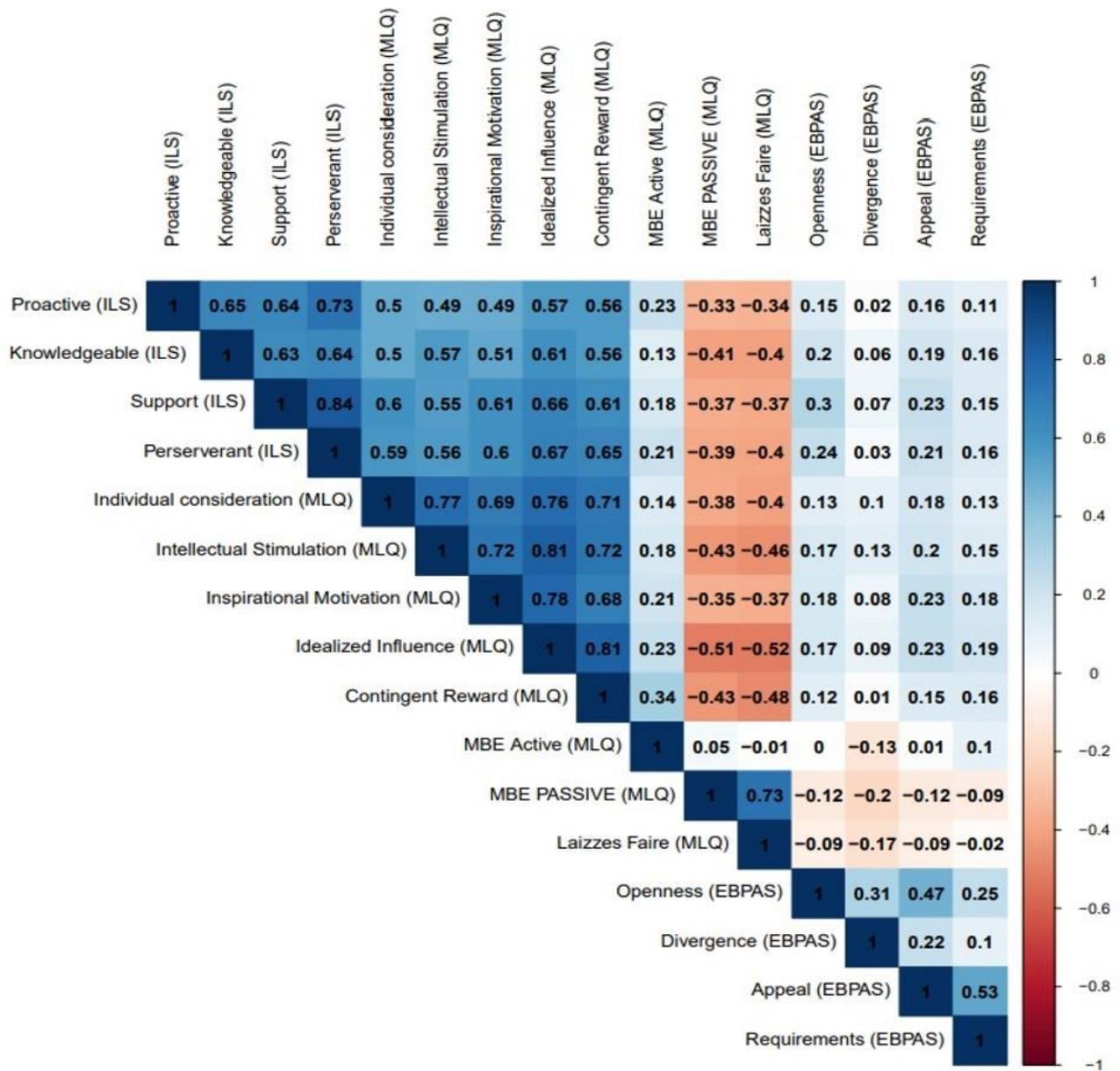


Figure 3

Correlation matrix including the ILS, MLQ and EBPAS. White squares indicate $p > .05$