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JOURNAL

RESEARCH ARTICLE

Inquiry-based learning method: Is it effective in improving madrasah teacher social competence in student-centered learning

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Abstract: This study aims to explore whether increasing the use of inquiry-based learning (IBL) by *Madrasah Aliyah* teachers in Indonesia improves the social competence of madrasah teachers in learning. Using data collected from IBL intervention program, this study used a quasi-experimental method to assess how IBL is associated with teachers' social competence, and analyzed using a difference-in-difference design. Generally, the social competence of madrasah teachers is only considered as a determinant of the practice of teaching Islamic religious education, but we found that the social competence of madrasah teachers can be positively influenced by the increased use of IBL in learning. Among the madrasah teacher social competence subscales, IBL is positively related to student engagement and teaching in learning. Analysis using student data shows that students' positive responses to Islamic religious education learning practices can mediate the relationship between IBL and the social competence of madrasa teachers. This research has implications for the development of the IBL model in improving the social competence of madrasa teachers in learning Islamic religious education.

Keywords: Inquiry-based learning, social competence, learning and instruction, madrasah teacher professionalism, teacher competence.

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1. Introduction

The social competence of madrasa teachers is the capacity to instruct in themselves as well as the capacity to ended up authority instructors (König, et al. 2021; Irmawati, Asri, & Aziz, 2021; Murkatik, Harapan, & Wardiah, 2020; Rusilowati, & Wahyudi, 2020), has been found to be related with different instructor characteristics and behaviors (Rusilowati, & Wahyudi, 2020; Karuniawati, Rahayu, & Ladamay, 2021). In specific, different

speculations depict that the social competence of madrasah (Islamic school) instructors decides the capacities and instructing strategies related to guidelines hone (Guillén-Gámez, et al. 2021; König, et al. 2021; Snoek, 2021; Suprayogi, Valcke, & Godwin, 2017). In expansion, the social competence of instructors contributes to self-leadership improvement (McGarr, & McDonagh, 2021; Guillén-Gámez, et al. 2021; Snoek, 2021) additionally moves forward the quality of an instructive institution.

However, most studies examining the relationship between teachers' social competence and learning practices have relied on cross-sectional data (Rusilowati, & Wahyudi, 2020; König, et al. 2021; McGarr, & McDonagh, 2021; Tambak, et al. 2020). This means that the data used for the analysis can allow for comparisons across respondents, but cannot explain changes over time, severely limiting the empirical ability to identify causality. Furthermore, the theoretical discussion of teacher social competence implies that there is a reciprocal or cyclical relationship with classroom experience (Tambak, & Sukenti, 2020; Lukiianchuk, et al. 2021; Komar, et al. 2021; Muna, Sunardi, & Widyastono, 2021). Thus, teacher social competence itself may be an outcome that is influenced by changes in instructional practice. Other research reveals that social competence implies the process of self-development with leadership in learning at madrasas (Efendi, 2021; Hamzah, Tambak, & Tanjung, 2020; Tambak, Ahmad, & Sukenti, 2020; Muna, Sunardi, & Widyastono, 2021).

Previous research also revealed the lack of integrated social competency research in madrasas. Most research still discusses teacher social competence in general without highlighting in depth the unique context and challenges faced by madrasa teachers (Tambak et al., 2020; Yonwong, Thongsuk, & Hemtasin, 2024). Other researchers also view the lack of an Islamic values approach in the study of social competence. Existing research has not elaborated much on how Islamic values can be practically integrated in the development of teachers' social competence (Tambak, & Sukenti, 2025; Tierney, Adams, & Ward, 2025). Other things in previous research reveal that the measurement of social competence is not yet optimal. Several studies have not offered specific and contextual measurement instruments for madrasah teachers' social competence (Tariq, 2025; Querevalú-Pazos, 2025; Tambak & Sukenti, 2024).

These various studies illustrate that social competence is more psychologically researched in the learning process, but has not revealed the strengthening of inquiry-based learning (IBL) in madrasa teacher learning (Iglesias & Tejada, 2024; Sam, 2024). This research is a new thing where the social competence of madrasa teachers is given a solution with IBL method that is different from previous research. Thus, to explore empirically the relationship between the social competence of madrasah teachers and instructional learning practices, this study uses data from IBL program intervention that took place in Pekanbaru City, Riau, Indonesia. In 2019, the Ministry of Religion of Riau Province provided four public Madrasah Aliyah (senior Islamic high school) in Pekanbaru with IBL program interventions to encourage teachers in madrasas by changing the learning method from teacher-centered lectures to student-centered IBL. In the IBL program, the treatment group teachers were given training on how to apply IBL and asked to use it in the classroom for one semester, while the seven control group teachers did not receive any encouragement to change their learning practices. With data pooled on teachers and students from the program, we used a quasi-experimental research method to assess how increased use of IBL over one semester was associated with changes in teacher social competence in madrasas in learning.

This research is very urgent to be carried out in order to empirically explore the relationship between the social competence of madrasa teachers and instructional practices using data from IBL program interventions in teaching Islamic religious education for madrasa teachers. IBL in various theories provides development in the learning process (Syakur, et al. 2020; Guo, et al. 2020; Miller, Severance, & Krajcik, 2021; Santyasa, Rapi, & Sara, 2020; Sukenti, & Tambak, 2020). The application of IBL can develop a quality and competitive learning atmosphere and environment, as well as the development of a tradition of higher-order thinking for students (Wu, & Wu, 2020; Safaruddin, et al. 2020; Pérez, & Rubio, 2020; Kim, 2020; Abuhmaid, 2020). This research aims to construct the development of social competence of madrasah teachers through social competence in the future profession. Thus, the focus of this study is to explore how IBL method affects the social competence of madrasa teachers in Islamic religious education.

2. Literature review

The IBL model is a learning activity that emphasizes the development of inquiry skills and thinking habits that enable students to continue their search for knowledge. This method provides students with the opportunity to investigate a problem (Abuhmaid, 2020; Santyasa, Rapi, & Sara, 2020). This learning process was developed so that students can be actively involved in the process of observing, asking, trying, processing data, and presenting, as well as concluding or even creating a new innovation. Maximum involvement of students in the learning process is an active activity (Safkolam, Madahae, & Saleah, 2024; Syakur, et al. 2020; Guo, et al. 2020). Therefore, it is hoped that this activity can trigger interaction between students and improve their literacy skills (Aidoo et al., 2024; Chu et al., 2021). The inquiry learning procedure has six steps, namely problem orientation, formulating the problem, making a hypothesis, exploration (gathering information or data), testing the hypothesis and making conclusions (Miller, Severance, & Krajcik, 2021; Pérez, & Rubio, 2020).

Teacher social competence is the teacher's ability to understand himself as an inseparable part of society and is able to develop his duties as a member of society and a citizen (Tambak & Sukenti, 2024; Rusilowati, & Wahyudi, 2020; König, et al. 2021; McGarr, & McDonagh, 2021). Teacher social competence is the teacher's ability to understand himself as an inseparable part of society and is able to develop his duties as a member of society and a citizen (Rusilowati, & Wahyudi, 2020; König, et al. 2021; McGarr, & McDonagh, 2021). The indicators of social competence are as follows: 1) Communicating verbally, writing and signing. 2) Using communication and information technology functionally. 3) Mingle effectively with students, fellow educators, education staff, parents or guardians of students (Tambak & Sukenti, 2025; Sánchez-Tarazaga et al., 2024; Irmawati, Asri, & Aziz, 2021; Murkatik, Harapan, & Wardiah, 2020).

3. Method

To assess the relationship between IBL and the social competence of madrasah teachers, this study used a quasi-experimental method (Djafar, et al. 2021) using survey data collected from teachers and students in two periods; before and after the use of IBL in the classroom for one semester. We mainly use two empirical methods: the difference-in-difference design and the instrumental variables through a two-stage least squares estimate (Djafar, et al. 2021). These two methods are often used in policy evaluation studies that aim to analyze the causal impact of policies on the outcome variables of interest (Angrist & Pischke, 2008). A total of fourteen Madrasah Aliyah in Pekanbaru, Riau, Indonesia participated in this study, seven of which consisted of a treatment group and seven a control group. The main targets of the program are teachers from these madrasas who teach one of the four core subjects of Islamic religious education: *Akidah Akhlak, Al-Qur'an Hadith, Fiqh,* and Islamic Cultural History, to students from Madrasah Aliyah (grade XI). A total of 139 teachers who meet these criteria participate in the IBL program. The response rates of the treatment group teachers for the pretreatment survey were 78% (56 teachers out of 72) and 67% (48 teachers out of 72) for the post-treatment survey. The control group teacher response rates were 55% (37 teachers out of 67) for the pre-treatment survey and 49% (33 teachers out of 67) for the post-treatment survey.

The analysis for this study was conducted based on disproportionate data, meaning that some teachers and students only participated in either the pre-treatment or post-treatment surveys. Among the 117 unique teachers in the sample, 57 (48.7%) teachers took part in both the pre-treatment and post-treatment surveys, while 36 (30.8%) teachers took part only in the pre-treatment survey and 24 (20 .5%) took part only in the post-treatment survey. In the final analysis of the sample for teacher survey data, the number of observations in the pre-treatment period was 93 (53.4%) and the number of observations in the post-treatment period was 81 (46.6%). For student survey data, among a unique sample of 1268 students, 1107 (87.3%) took part in the pre- and post-treatment survey, while 109 (8.6%) only took part in the pre-treatment survey and 52 (4.1) %) took part only in the post-treatment survey.

A summary of the basic background characteristics of teachers and students is presented that among the 56 teachers in the treatment group, 82% were female, 38% had attained a master's degree or higher education level, the average total teaching experience was 150.13 months (SD 99 ,39), or about 12.5 years, the average school year at the current school is 24.15 months (SD 41.81), or about 2 years, and 79% are on permanent contracts. The basic means t-test between the treatment group and the control group found no statistically significant difference between the two groups. Among the treatment group students in the pre-treatment phase, 44% were female and had a mean language score of 2.66 (score range: 0 to 5; SD 1.48). T-tests of the baseline revealed that there were no significant differences between the treatment and control group students in terms of gender composition and Islamic religious education scores, but the treatment group had a higher proportion of students with parents who had a bachelor's degree. To directly account for these differences, we included them as control variables across all regression models.

The selection of madrasahs in the treatment and control groups was not random, which could potentially bias estimates and limit the extent to which causal interpretations can be made. Taking into account the representativeness of the sample, one treatment school is selected from seven different school districts within the city, and a suitable control school is selected within the same district. Control madrasas were selected to be the same sex (one sex, at the madrasah and grade level) as treatment schools, and were located within 2 km. Thus, we have two madrasah (one experimental school and one control school) per district in our sample, as close as possible to each other in terms of gender structure and geographic location. Madrasa teachers or students themselves did not voluntarily or self-select into the treatment or control groups, which eliminates concerns for potential selection bias.

To assess the relationship between IBL and the social competence of madrasah teachers, this study used a quasi-experimental method using survey data collected from teachers and students in two periods; before and after the use of IBL in the classroom for one semester. We mainly use two empirical techniques: the difference-in-difference design and the instrumental variables through a two-stage least squares estimate. These two methods are often used in policy evaluation studies that aim to analyze the causal impact of policies on the outcome variables of interest (Angrist & Pischke, 2008). For the analysis using teacher data, the dependent variable of interest is a measure of teacher self-efficacy and its subscale. For the analysis using student data, the dependent variables of interest were students' perceptions of their teacher's efforts to encourage interest, level of class preparation, students' self-assessments about their class participation, and self-assessments about how often they shared ideas in class. class. Since teacher and student data can only be linked at the school level, and there were only 14 madrasa in the study, directly assessing the relationship between student and madrasa teacher variables is not feasible. Therefore, we first analyzed teacher data to assess how IBL was associated with teachers' social competence and its subscales. Next, we analyzed student data to evaluate how students responded to IBL. This made it possible to indirectly assess whether the relationship between IBL and social competence might be related to IBL-induced changes in students.

For madrasa teacher survey data, across all variables and periods, the rate of missing scores ranged from 0.6% to 2.3%. For student survey data, the two variables had two missing values each, for a 0.08% loss rate. Average imputation is used to handle missing cases. Each missing value is replaced by the mean value of the relevant variable, taken from the appropriate school and respondent period. Although not presented in the study, there was no significant difference in the results compared with the analysis performed after deletion of the list of respondents with missing values for any of the variables included in the regression model.

We first estimated the treatment effect of the IBL program using a difference-in-difference design. The difference-in-difference technique captures the effect of treatment by comparing the change in the mean over time of the outcome variable for the treatment group with the change in the mean over time for the control group. The required assumption is that in the absence of treatment, changes over time in the outcome variables for the treatment and control groups will be identical. This assumption is known as the parallel trend assumption, because it requires time trends in the outcome variables to be parallel

between the two groups prior to treatment. He should note that the assumptions require trends to be identical, not the rate of outcome variables. If this assumption holds, the difference in changes over time between the treatment and control groups is interpreted as a causal effect of treatment (Khaldi, 2017). Empirical verification of the assumption of parallel trends requires data to be collected at multiple time points before treatment takes place. However, because we only have data for a single period before and after treatment, we cannot directly assess the assumption of parallel trends. Nonetheless, due to the relatively high degree of homogeneity across the treatment and control groups, it is unlikely that any differences in trends in the outcome variables were attributable to factors other than the IBL program intervention.

The empirical model (Gaciu, 2020) that we used to derive the difference-in-difference estimate is stated: $Yijt=\beta 0+\beta 1 Treatjx Postt+\beta 2 Treatj+\beta 3 Postt+Xig+\varepsilon ijt$ where is the subscript i; J; and t represents the individual (either teacher or student), school, and period, respectively. yijt is the dependent variable of interest, such as social competence for madrasah teachers or student responses for students, individual i in school j at time t: All dependent variables are standardized to have a mean of 0 and a standard deviation of 1, based on the mean and standard deviation of group scores control. This was done to facilitate interpretation, especially in terms of how the results changed relative to the control group. If it is equal to 1, then the respondent belongs to a nursing school, and if 0, then the respondent is part of the madrasa control. Postt is equal to 1 if time t is the post-treatment period (i.e., after the fall 2016 semester) and 0 if time t is the pre-treatment period (i.e., before the intervention). Treatj Postt (Djafar, et al. 2021) is an interaction between indicator variables for treatment and time period. Xi is a vector control variable consisting of individual characteristics such as: respondents. For madrasah teachers, they included gender, education level, total teaching experience (in months), current teaching experience at madrasas (in months), and type of employment contract. For students, they included the student's gender, parental education level, eldest child status, and test math scores. ijt is an error term, clustered at the school level.

4. Result

4.1. Teacher analysis

Table 1 reports the effect of the IBL program on the social competence of madrasah teachers and their subscales, estimated through the design differences expressed in (Equation (1)). The first column shows that the IBL program is associated with an increase in the social competence of madrasah teachers by 0.942 standard deviations (p < 0.01). Column 2 reports that the IBL program has a significant relationship with the social competence of madrasah teachers in instruction with a standard deviation of 1.011 (p < 0.01), and Column 4 reports that social competence in engagement is significantly related to the IBL program of 0.899 standard deviations (p <0.01). The results in column 3 show that the IBL program has no significant effect on the social competence of madrasah teachers in classroom management. This indicates that social competence in teaching and student engagement drive the positive impact that IBL programs have on the social competence of madrasah teachers as a whole. Among the madrasah teacher social competence subscales, IBL had the strongest impact on teachers' social competence in engagement, which might be expected, given that the central change reflected in treatment was changes in instructional practice.

Table 2 reports the results of the instrumental approach variables on the impact of using IBL on the social competence of madrasah teachers and their subscales. The results of the first stage regression (Equation (2)) are found in column 1 of Panel (b). The intervention program increased the likelihood of implementing IBL in the classroom either "often" or "in all or almost all subjects" by 44.6 percentage points (p < 0.05). This provides further evidence that the IBL intervention program causes significant changes in the way teaching takes place in the classroom. Panel (a) of Table 2 reports the estimates of the second stage of the instrumental-variable approach regression (Equation (3)). The predicted IBL frequency values obtained from the first-stage regression estimation were collected and entered into the

regression to estimate Equation (3). In column 1 of panel (a), an exogenous increase in the use of IBL was associated with an increase in the social competence of madrasah teachers by 2,270 standard deviations (p < 0.1). Self-efficacy in instruction and engagement was also found to be positively influenced by IBL, increasing by 2.115 standard deviations (p < 0.1) and 2.016 standard deviations (p < 0.05), respectively. As was the case in the difference-within-difference estimate, IBL was found to have no significant effect on social competence in classroom management.

4.2. Student analysis

The positive associations found between madrasah teachers' leadership competencies and IBL could be mediated by the effect that IBL has on students. At Madrasah Aliyah Pekanbaru, students are placed in one classroom, and teachers in charge of different subjects come in classes at different hours to teach their respective subjects, so grade level analyzes linking student and teacher outcomes cannot be carried out. Students and teachers can connect at the madrasah level, but because our data contains only twelve madrasas, the school-level analysis would lack sufficient statistical power. Because of this, we can only estimate the relationship between IBL student reports and student responses, and indirectly conclude that any effect found in the student data may be related to the positive association found between IBL and teachers' social competence in the madrasah teacher data.

Tabel 1. IBL and social competence: Difference-in-Differences estimates.

	(1)	(2)	(3)	(4)
Dependent variable:	Social competence of madrasa teachers	Social competence in instruction	Social competence in management	Social competence in engagement
Post Treat	0.942***	1.011***	0.509	0.899***
	-0.299	-0.272	-0.327	-0.242
Post	0.012	0.318	0.028	0.013
	-0.202	-0.184	-0.235	-0.166
Treat	0.740** (0.245)	0.811** (0.263)	0.588** (0.250)	0.571*** (0.179)
Student math score	0.046	0.103	0.089	0.067
	-0.165	-0.136	-0.16	-0.157
Female	0.091	0.202	0.088	0.02
	-0.473	-0.452	-0.497	-0.315
MA and above	0.082	0.022	0.077	0.083
	-0.304	-0.264	-0.311	-0.237
Total teaching experience	0.004**	0.003**	0.003*	0.003*
	-0.002	-0.001	-0.002	-0.001
Experience at current school	0.001	0.002	0	0.002
	-0.002	-0.003	-0.002	-0.002
Permanent	0.724*	0.559	0.662	0.674**
	-0.378	-0.338	-0.446	-0.272
Observations	174	174	174	174
R-squared	0.222	0.319	0.131	0.212

Table 3 reports the estimated difference-in-difference obtained through equation (1) using student survey data. Estimates were obtained for the entire sample as well as for the madrasah subsample consisting of the three treatments group madrasah in which IBL increased the most and their respective control madrasahs matched. Responses from the teacher survey and student survey showed that teachers from Madrasah Aliyah Negeri 1, Madrasah Aliyah Negeri 2, and Madrasah Aliyah Negeri 4 had the largest increase in the use of IBL after the IBL program. Column 2 of panel (a) shows that the

IBL intervention program led to an increase in the perception of efforts to attract teachers' interest by 0.155 standard deviation (p < 0.1). There was no statistically significant relationship between the IBL program and other student variables. In panel (b), where the analysis was limited to the three care schools in which: IBL increased the most and their matched control madrasah, we found that the IBL program increased the madrasa teacher's perception of interest by persuasion effort by 0.360 standard deviation (p < 0, 05). This shows very good development.

Estimates obtained through the instrumental variable approach are reported in table 4. Separate estimates are reported for those obtained with the entire sample (Panel (a)) and the subset of the three madrasahs with the greatest improvement in IBL and their matched control schools (Panel (b)). In Panel (a), it was found that IBL increased the perception of madrasa teacher interest induction efforts by 0.792 standard deviation (p < 0.1) and the extent to which students shared ideas with each other in class with a standard deviation of 0.995 (p < 0.1). There is no significant relationship with the perception of teacher class preparation or student class participation. When the analysis is limited to three madrasahs that experienced the greatest increase in IBL and their matched control madrasahs, increased use of IBL was associated with an increase in the perception of classroom preparation teachers by 0.674 standard deviations (p < 0.1), an increase in perceptions of the madrasa teacher's interest in persuasion efforts of 1.010 standard deviations (p < 0.1 0.01), and an increase in students' sharing of ideas in class with a standard deviation of 0.724 (p < 0.1).

Table 2. IBL and madrasa teacher's social competence: Two-stage least squares estimate.

(a) Second stage				
Dependent variable:	(1)	(2)	(3)	(4)
	Social competence of madrasa teachers	Social competence in instruction	Social competence in management	Social competence in engagement
Predicted IBL	2.270*	2.115*	1.143	2.016**
	-1.19	-1.159	-0.945	-0.949
Post	0.122	0.421	0.25	0.378
	-0.646	-0.636	-0.509	-0.522
Treat	841** (0.334)	0.768** (0.325)	.603** (0.288)	0.597** (0.259)
Controls	YES	YES	YES	YES
Observations	174	174	174	174

(b) First stage	
Dependent variable: Inquiry-based learning	-1
Post Treat	0.446** (0.158)
Post	0.194
	-0.131
Treat	0.013
	-0.066
Controls	YES
Observations	174
F-statistic	14.89

Table 3. IBL and student's outcomes: Difference-in-differences estimates.

(a) Sample: All schools				
Dependent variable:	(1)	(2)	(3)	(4)
	Teacher preparation	Teacher inducement	Share idea	Class participation
Treat Post	0.09	0.155*	0.159	0.093
	-0.086	-0.084	-0.114	-0.079
Controls	YES	YES	YES	YES
Observations	2266	2266	1944	2266
R-squared	0.013	0.011	0.011	0.072
(b) Sample: IBL top 3 schools				
Dependent variable:	(1)	(2)	(3)	(4)
	Teacher preparation	Teacher inducement	Share idea	Class participation
Post Treat	0.24	0.360**	0.214	0.027
	-0.13	-0.09	-0.157	-0.114
Controls	YES	YES	YES	YES
Observations	1146	1146	988	1146
R-squared	0.012	0.018	0.011	0.059

Tabel 4. IBL and student's outcomes: Two-stage least squares estimate.

(a) Second stage - All schools				
Dependent variable:	(1)	(2)	(3)	(4)
	Teacher preparation	Teacher inducement	Share idea	Class participation
Predicted IBL	0.457	0.792*	0.995*	0.472
	-0.438	-0.439	-0.603	-0.429
Controls	YES	YES	YES	YES
Observations	2266	2266	1944	2266
(b) Second stage - IBL top 3				
Dependent variable:	(1)	(2)	(3)	(4)
	Teacher preparation	Teacher inducement	Share idea	Class participation
Predicted IBL	0.674*	1.010***	0.724*	0.075
Controls	YES	YES	YES	YES
Observations	1146	1146	988	1146
(c) First stage Dependent variable: Inquiry-based learning	-1	-2		
	All schools	IBL top 3		
Treat Post	0.196***	0.357***		
	-0.038	-0.052		
Controls	YES	YES		
Observations	2266	1146		
F-statistic	346.9	295.38		

5. Discussion

In this study, we explore whether increasing the use of IBL by madrasah aliyah teachers in Indonesia improves the social competence of madrasah teachers. Estimates obtained using a difference-in-difference design and an instrumental variable approach found that the IBL program had a positive effect on the social competence of madrasah teachers. Also, analysis of student data using a difference-in-difference design found that the IBL program positively affected students' perceptions of the level of effort a teacher exerted to provoke interest. Estimation using an instrumental variable approach on the subset of schools with the strongest increase in IBL use found that IBL was positively related to madrasah teachers' perceptions of class preparation, efforts to induce madrasa teacher interest, and the frequency with which students shared ideas in class.

The positive associations found between IBL and the social competence of madrasah teachers indicate that learning practices are not only the result of madrasah teachers' social competence, as is generally perceived, but can also lead to changes in madrasah teachers' social competences (Suprayogi, Valcke, & Godwin, 2017; Zee & Koomen, 2016; Tambak & Sukenti, 2024). Based largely on analysis using cross-sectional data, researchers tend to treat the social competence of madrasa teachers only as a determinant of the learning method approach (Suprayogi, Valcke, & Godwin, 2017; Zee & Koomen, 2016; Tambak, & Sukenti, 2020; Tambak, et al. al.2020; Ritonga, et al. 2021). This study provides empirical evidence for alternative understanding; it could also be for learning practices to influence the social competence of madrasa teachers. Analysis of the data collected over two time periods with the quasi-experimental IBL method provided greater support for interpreting causality than previous studies based on cross-sectional data (Robiah et al., 2024; Tambak, et al. 2021; Haqquddin et al., 2024; Muhajir, Tambak & Sukenti, 2024). This study introduces teaching practice as a mediating factor influencing the pedagogy of madrasah teachers, contributing to the literature seeking to understand teacher leadership competency development (Lobczowski, et al. 2021; Tambak, & Sukenti, 2019; Tambak, et al. 2021; Ritonga, et al. 2021).

From the three main sources of developing social competence of madrasah teachers rooted in leadership cognitive theory, it is possible that experience plays a major role in improving the social competence of madrasah teachers. The direct experiences experienced by teachers, both in formal and informal contexts, greatly influence their ability to interact effectively with various parties. Social competence includes the ability to communicate, work together, build relationships, and solve social problems in an educational environment. Experience gives teachers the opportunity to learn, develop, and understand the various dynamics that occur in madrasas (Tambak & Sukenti, 2024; Sánchez-Tarazaga et al., 2024; Irmawati, Asri, & Aziz, 2021). Overall, experience is one of the main aspects in building the social competence of madrasa teachers. Through experience, teachers can develop better social sensitivity, communication skills and collaboration abilities, so that they are able to carry out their roles in a more professional and Islamic manner (Sukenti et al., 2022; Ritonga, et al. 2021). Experience mastery occurs when teachers view their performance as madrasa teachers to be successful. It is possible that IBL leads to a more positive educational experience among students, leading to an increase in the social competence of madrasah teachers (Owens, and Hite. 2020; Untari, et al. 2020; Hussein, 2021; Tambak, Ahmad, & Sucenti. 2020; Untari et al. 2020; Hussein, 2021; Tambak, Ahmad, & Sucenti. 2020;). Due to data limitations, we did not directly assess the relationship between students and the social competence of madrasah teachers. However, the positive associations found between IBL and student outcomes support the possibility of mastery experiences (Panadero, Jonsson, & Botella, 2017; Marsh, et al. 2019; Tambak, Amril, & Sukenti, 2021; Hamzah, Sukenti, Tambak, & Tanjung, 2020). Among the three madrasahs that experienced the greatest increase in IBL, were shown to have a positive and statistically significant change in the way they carried out their teacher's efforts to provoke interest and preparatory classes, and also increased their frequency of sharing ideas with other students in the class (Ahmad et al., 2025; Tambak, Amril, & Sukenti, 2021). Students have more positive perceptions of teachers in the classroom, if conveyed to teachers, can contribute to teachers who understand their own teaching to be effective (Muhajir et al., 2024; Untari et al. 2020; Hussein, 2021). Also, sharing ideas in class is likely related to involvement in course material. Madrasa teachers' positive perceptions and more involvement in the classroom through sharing ideas tend to lead to mastery experiences that increase teacher social competence (Sukenti et al., 2022; Ritonga, et al. 2021).

6. Conclusion

Estimates obtained using a difference-in-difference design and an instrumental variable approach found that the IBL program had a positive effect on the social competence of madrasah teachers in Islamic religious education learning. Also, analysis of student data using a difference-in-difference design found that the IBL program positively affected students' perceptions of the level of effort a teacher exerted to provoke interest. Estimation using an instrumental variable approach on the subset of schools with the strongest increase in IBL use found that IBL was positively related to teachers' perceptions of class preparation, attempts to induce teacher interest, and the frequency with which students share ideas in class.

This study provides empirical evidence for alternative understanding; it could also be for learning practices to influence the social competence of madrasa teachers in learning Islamic religious education. Analysis of the data collected over two time periods by quasi-experimental methods provided greater support for causal interpretation than previous studies based on cross-sectional data. This study introduces teaching practice as a mediating factor that affects the social competence of madrasah teachers, a contribution to the literature that seeks to understand the development of madrasah teachers' leadership competencies in Islamic religious education learning. The implication of this research is to develop the theory of "inquiry-based learning on the social competence of madrasa teachers" in learning Islamic religious education. The findings of this study can be universally developed by the Ministry of Religion of the Republic of Indonesia in all madrasas in learning at madrasas. This study only assessed the impact of IBL immediately after it was implemented for one semester. To gain a more complete understanding of how IBL affects the social competence of madrasah teachers, the duration of using the instructional approach can be extended (eg more than one semester). Also, long-term effects should be assessed through outcomes measured at later time points. So, madrasa teacher self-efficacy is a crucial thing to be developed in language learning through a capable IBL process in the madrasa teacher profession.

Author Contribution Statement

Contributions of the authors in this article: Rasyidi and Aulia Hafizoh contributed as concepts and drafters of the article; Maskiah binti Masrom, Daharmi Astuti, and Ibrahim Narongraksakhet contributed as data analyzers and interpreters; Ilyas Husti as the drafter of the manuscript; Andi Nurhaliza contributed in collecting data and critically revising the article. All authors agree to take responsibility for all aspects of this work.

Disclosure of Interests

We have no conflict of interest to declare

Acknowledgements

References

Abuhmaid, A. M. (2020). The Efficiency of Online Learning Environment for Implementing Inquiry-based learning: Students' Perceptions. *International Journal of Higher Education, 9*(5), 76-83. https://doi.org/10.5430/ijhe.v9n5p76.

Ahmad, K. A., Asni, F., Hasbulah, M. H., Hashom, H., Mustafa, W. A., Noor, A. M., ... & Nasir, K. (2025). Mobile Learning of Islamic Studies: A Comprehensive Review. *Journal of Advanced Research in Applied Sciences and Engineering Technology*, *48*(2), 211-224. https://doi.org/10.37934/araset.48.2.211224

Akharraz, M. (2021). The Impact of Inquiry-based learning on Students' Cultural Awareness. *International Journal of Language and Literary Studies, 3*(2), 54-80. https://doi.org/10.36892/ijlls.v3i2.601

Aksela, M., & Haatainen, O. (2019). Inquiry-based learning (IBL) in Practise: Active Teachers' Views of Its' Advantages And Challenges. In *Integrated Education for the Real-World 5th International STEM in Education Conference Post-Conference Proceedings*. Queensland University of Technology.

Aidoo, B., Chebure, A., Gyampoh, A. O., Tsyawo, J., & Quansah, F. (2024). Assessing Student Teachers' Motivation and Learning Strategies in Digital Inquiry-Based Learning. *Education Sciences*, *14*(11), 1233. https://doi.org/10.3390/educsci14111233

Alotaibi, M. G. (2020). The Effect of Inquiry-based learning Model on Persuasive Writing Skills of Saudi EFL Secondary School Students. *English Language Teaching*, *13*(7), 19-26. https://doi.org/10.5539/elt.v13n7p19.

Angrist, J. D., & Pischke, J. S. (2008). Parallel worlds: fixed effects, differences-in-differences, and panel data. In *Mostly harmless econometrics* (pp. 221-248). Princeton University Press. https://doi.org/10.1515/9781400829828-010.

Berselli, G., Bilancia, P., & Luzi, L. (2020). Inquiry-based learning of advanced CAD/CAE tools in engineering education. *International Journal on Interactive Design and Manufacturing (IJIDeM)*, *14*(3), 1071-1083. https://doi.org/10.1007/s12008-020-00687-4.

Chaijum, N., & Hiranyachattada, T. (2020). Integrated Learning and Inquiry-based learning for Project of Electrical Measurement and Instrumentations in Electrical Engineering Course. *European Journal of Science and Mathematics Education*, *8*(1), 6-11. https://files.eric.ed.gov/fulltext/EJ1242181.pdf.

Chu, S. K. W., Reynolds, R. B., Tavares, N. J., Notari, M., & Lee, C. W. Y. (2021). *21st century skills development through inquiry-based learning from theory to practice*. Springer International Publishing.

Djafar, H., Yunus, R., Pomalato, S. W. D., & Rasid, R. (2021). *Qualitative and Quantitative Paradigm Constellation In Educational Research Methodology.* International Journal of Educational Research & Leadership Sciences, 2*(2), 339-345. https://doi.org/10.51601/ijersc.v2i2.70.*

Efendi, S. (2021). Lecturer's Social competence in Developing Student Learning at the National University. *Jurnal Mantik*, *5*(2), 701-706. https://doi.org/10.35335/mantik.Vol5.2021.1385.pp701-706.

Gaciu, N. (2020). *Understanding Quantitative Data in Educational Research*. Sage.

Guillén-Gámez, F. D., Mayorga-Fernández, M., Bravo-Agapito, J., & Escribano-Ortiz, D. (2021). Analysis of teachers' leadership digital competence: Identification of factors predicting their acquisition. *Technology, Knowledge and Learning*, *26*(3), 481-498. https://doi.org/10.1007/s10758-019-09432-7.

Guo, P., Saab, N., Post, L. S., & Admiraal, W. (2020). A review of inquiry-based learning in higher education: Student outcomes and measures. *International Journal of Educational Research*, *102*, 101586. https://doi.org/10.1016/j.ijer.2020.101586.

Guo, P., Saab, N., Wu, L., & Admiraal, W. (2021). The Community of Inquiry perspective on students' leadership presence, cognitive presence, and academic performance in online project-based learning. *Journal of Computer Assisted Learning*, *37*(5), 1479-1493. https://doi.org/10.1111/jcal.12586.

Hamzah, D. S., Tambak, S., & Tanjung, W. U. (2020). Overcoming self-confidence of Islamic religious education students: The influence of personal learning model. *Journal of Education and Learning (EduLearn)*, *14*(4), 582-589. https://doi.org/10.11591/edulearn.v14i4.16759.

Haqquddin, M. F., Rusman, R., Tambak, S., & Wibowo, A. (2024). Developing Critical and Creative Thinking Skills Through the Cooperative Learning Model of Team Games Tournament in Islamic Education at SMPN 1 Babat Lamongan. *Ar-Fachruddin: Journal of Islamic Education*, *1*(2), 82-92. https://doi.org/10.7401/gfh85p67

Hussein, B. (2021). Addressing Collaboration Challenges in Inquiry-based learning: The Student's Perspective. *Education Sciences*, *11*(8), 434. https://doi.org/10.3390/educsci11080434.

Iglesias, P., & Tejada, J. (2024). Practice as research through inquiry-based learning: A pedagogical intervention with music students in higher education. *Education Sciences*, *14*(7), 738. **https://doi.org/10.3390/educsci14070738**

Irmawati, D. K., Asri, T. M., & Aziz, A. L. (2021). How EFL Teachers Deal with Social competence Development for the Teaching of Writing: A Study on Higher Educational Level in Indonesian Context. *Journal of Education and e-Learning Research*, *8*(1), 42-51. https://doi.org/10.20448/journal.509.2021.81.42.51.

Jalinus, N., Syahril, S., Nabawi, R. A., & Arbi, Y. (2020). How Inquiry-based learning and Direct Teaching Models Affect Teamwork and Welding Skills Among Students. *International Journal of Innovation, Creativity and Change.*, *11*(11), 85-111. https://files.eric.ed.gov/fulltext/ED610846.pdf.

Karuniawati, E., Rahayu, S., & Ladamay, I. (2021, April). Education, Working Group Activities and Leadership Competencies Their Effect on Teacher Leadershipism. In *2nd Annual Conference on Leadership Science and Humanities (ANCOSH 2020)* (pp. 75-78). Atlantis Press. https://doi.org/10.2991/assehr.k.210413.018.

Khaldi, K. (2017). Quantitative, qualitative or mixed research: which research paradigm to use?. *Journal of Educational and Leadership Research*, *7*(2), 15-15. https://doi.org/10.5901/jesr.2017.v7n2p15.

Kim, K. J. (2020). Inquiry-based learning approach to increase medical student empathy. *Medical education online*, *25*(1), 1742965. https://doi.org/10.1080/10872981.2020.1742965.

Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Inquiry-based learning: A review of the literature. *Improving schools*, *19*(3), 267-277. https://doi.org/10.1177/1365480216659733.

Komar, O. A., Chuchalina, Y. M., Kramarenko, A. N., Torchynska, T. A., & Shevchuk, I. V. (2021). Agile Approach in Training Future Primary School Teachers for Resolving Complex Leadership Situation. *International Electronic Journal of Elementary Education*, *13*(4), 469-477. https://doi.org/10.26822/iejee.2021.205.

König, J., Blömeke, S., Jentsch, A., Schlesinger, L., née Nehls, C. F., Musekamp, F., & Kaiser, G. (2021). The links between social competence, instructional quality, and mathematics achievement in the lower secondary classroom. *Educational Studies in Mathematics*, *107*(1), 189-212. https://doi.org/10.1007/s10649-020-10021-0.

Ljung-Djärf, A., Magnusson, A., & Peterson, S. (2014). From doing to learning: Changed focus during a pre-school learning study project on organic decomposition. *International Journal of Science Education*, *36*(4), 659-676. https://doi.org/10.1080/09500693.2013.822604.

Lobczowski, N. G., Lyons, K., Greene, J. A., & McLaughlin, J. E. (2021). Leadershiply shared metacognition in a inquiry-based learning environment: A comparative case study. *Learning, Culture and Leadership Interaction*, *30*, 100543. https://doi.org/10.1016/j.lcsi.2021.100543.

Lukiianchuk, A., Kharahirlo, V., Sakhno, O., Tataurova-Osyka, G., & Stadnik, N. (2021). Conditions for the development of psychological and social competence of teachers of vocational (leadership and technical) education. *Linguistics and Culture Review*, *5*(S3), 678-696.

McGarr, O., & McDonagh, A. (2021). Exploring the digital competence of pre-service teachers on entry onto an initial teacher education programme in Ireland. *Irish Educational Studies*, *40*(1), 115-128. https://doi.org/10.1080/03323315.2020.1800501.

Miller, E. C., Severance, S., & Krajcik, J. (2021). Motivating teaching, sustaining change in practice: Design principles for teacher learning in inquiry-based learning contexts. *Journal of Science Teacher Education*, *32*(7), 757-779. https://doi.org/10.1080/1046560X.2020.1864099.

Muhajir, M., Tambak, S., & Sukenti, D. (2024). Learner-Centered Education Affect for Madrasah Teacher Personality Competence: The Cases of Project-Based Learning Methods. *International Journal of Religion*, *5*(11), 947-959.

Muhajir, M., Tambak, S., Sukenti, D., Husti, I., Zamsiswaya, Z., Sawaluddin, S., ... & Harahap, M. (2024). Development of Madrasa Teacher Leadership Competency: Involving Project-Based Learning Methods in Students-Centered Learning. *Pegem Journal of Education and Instruction*, *14*(3), 243-255. http://doi.org/10.47750/pegegog.14.03.23

Mukti, Y. P., Masykuri, M., Sunarno, W., Rosyida, U. N., Jamain, Z., & Dananjoyo, M. D. (2020). Exploring the Impact of inquiry-based learning and discovery learning to the students' learning outcomes: Reviewed from the analytical skills. *Jurnal Ilmiah Pendidikan Fisika Al-Biruni*, *9*(1), 121-131. https://doi.org/10.24042/jipfalbiruni.v9i1.4561.

Muna, A. N., Sunardi, S., & Widyastono, H. (2021). Teachers' Efforts to Improve Leadership Competency in Learning Children with Special Needs in Inclusion Basic Schools in Surakarta. *IJDS: Indonesian Journal of Disability Studies*, *8*(1), 61-72. https://doi.org/10.21776/ub.ijds.2021.008.01.04.

Murkatik, K., Harapan, E., & Wardiah, D. (2020). *The Influence of Leadership and Social competence on Teacher's Performance. Journal of Leadership Work and Science Education, 1(1), 58-69. https://doi.org/10.52690/jswse.v1i1.10*.

Owens, A. D., & Hite, R. L. (2020). Enhancing student communication competencies in STEM using virtual global collaboration project based learning. *Research in Science & Technological Education*, 1-27. https://doi.org/10.1080/02635143.2020.1778663.

Pérez, B., & Rubio, Á. L. (2020, February). A inquiry-based learning approach for enhancing learning skills and motivation in software engineering. In *Proceedings of the 51st ACM Technical Symposium on Computer Science Education* (pp. 309-315). https://doi.org/10.1145/3328778.3366891.

Querevalú-Pazos, M. C. (2025). Inquiry-based science teaching in Peru: A systematic literature review (2016–2022). *Education 3-13*, *53*(1), 32-50. https://doi.org/10.1080/03004279.2022.2164699

Ritonga, M., Tambak, S., Lahmi, A., Handayani, I., & Riyadi, S. (2021). Strategies for developing tarkib arabic exercises instruments for strengthening the understanding of yellow book. *International Journal of Entrepreneurship*, *25*, 1-9. https://www.proquest.com/openview/16be9cf59b3d6665821366079f826837/1?cbl=29727&pq-origsite=gscholar.

Robiah, S., Tambak, S., Siregar, J., Hafizah, J., & Swastika, A. (2024). Strengthening teachers' skills in using an enrichment biology e-module based on flipbook integrated with Qur'anic and Sunnah values. *Journal of Community Service and Empowerment*, *5*(3), 661-667. https://doi.org/10.22219/jcse.v5i3.37499

Rusilowati, U., & Wahyudi, W. (2020, March). The Significance of Educator Certification in Developing Pedagogy, Personality, Leadership and Leadership Competencies. In *2nd Leadership and Humaniora Research Symposium (SoRes 2019)* (pp. 446-451). https://doi.org/10.2991/assehr.k.200225.095.

Safaruddin, S., Ibrahim, N., Juhaeni, J., Harmilawati, H., & Qadrianti, L. (2020). The Effect of Inquiry-based learning Assisted by Electronic Media on Learning Motivation and Science Process Skills. *Journal of Innovation in Educational and Cultural Research*, *1*(1), 22-29. https://doi.org/10.46843/jiecr.v1i1.5.

Safkolam, R., Madahae, S., & Saleah, P. (2024). The effects of inquiry-based learning activities to understand the nature of science of science student teachers. *International Journal of Instruction*, *17*(1), 479-496. https://doi.org/10.29333/iji.2024.17125a

Sam, R. (2024). Systematic review of inquiry-based learning: assessing impact and best practices in education. *F1000Research*, *13*, 1045.

Sánchez-Tarazaga, L., Sanahuja Ribés, A., Ruiz-Bernardo, P., & Ferrández-Berrueco, R. (2024). Social competences in pre-service education: what do future secondary teachers think?. *Journal of Education for Teaching*, *50*(1), 5-19. https://doi.org/10.1080/02607476.2023.2247340

Santamaría-Cárdaba, N. (2020). Families, experiments, and nature: Learning science through project-based learning. *School Science and Mathematics*, *120*(8), 467-476. **https://doi.org/10.1111/ssm.12438**.

Santyasa, I. W., Rapi, N. K., & Sara, I. (2020). Project Based Learning and Academic Procrastination of Students in Learning Physics. *International Journal of instruction*, *13*(1), 489-508. https://doi.org/10.29333/iji.2020.13132a.

Simonton, K. L., Layne, T. E., & Irwin, C. C. (2021). Inquiry-based learning and its potential in physical education: an instructional model inquiry. *Curriculum Studies in Health and Physical Education*, *12*(1), 36-52. https://doi.org/10.1080/25742981.2020.1862683.

Snoek, M. (2021). Educating quality teachers: how teacher quality is understood in the Netherlands and its implications for teacher education. *European Journal of Teacher Education*, 1-19. https://doi.org/10.1080/02619768.2021.1931111.

Sukenti, D., & Tambak, S. (2020). Developing Indonesian Language Learning Assessments: Strengthening the Personal Competence and Islamic Psycholeadership of Teachers. *International Journal of Evaluation and Research in Education*, *9*(4), 1079-1087. http://doi.org/10.11591/ijere.v9i4.20677.

Sukenti, D., Tambak, S., & Siregar, E. (2021). Learning Assessment for Madrasah Teacher: Strengthening Islamic Psycholeadership and Emotional Intelligence. *AL-ISHLAH: Jurnal Pendidikan*, *13*(1), 725-740. https://doi.org/10.35445/alishlah.v13i1.552.

Suprayogi, M. N., Valcke, M., & Godwin, R. (2017). Teachers and their implementation of differentiated instruction in the classroom. *Teaching and Teacher Education*, *67*, 291-301. https://doi.org/10.1016/j.tate.2017.06.020.

Syakur, A., Musyarofah, L., Sulistiyaningsih, S., & Wike, W. (2020). The Effect of Inquiry-based learning (PjBL) Continuing Learning Innovation on Learning Outcomes of English in Higher Education. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, *3*(1), 625-630. https://doi.org/10.33258/birle.v3i1.860.

Tambak, S., & Sukenti, D. (2020). Strengthening Islamic Behavior and Islamic Psycholeadership in Developing Leadership Madrasah Teachers. *Jurnal Cakrawala Pendidikan*, *39*(1), 65-78. https://doi.org/10.21831/cp.v39i1.26001.

Tambak, S., Ahmad, M. Y., & Sukenti, D. (2020). Strengthening Emotional Intelligence in Developing the Madrasah Teachers' Leadershipism (Penguatan Kecerdasan Emosional dalam Mengembangkan Profesionalisme Guru Madrasah). *Akademika*, *90*(2), 27-38. https://doi.org/10.17576/akad-2020-9002-03.

Tambak, S. (2021). The Method of Counteracting Radicalism in Schools: Tracing the Role of Islamic Religious Education Teachers in Learning. *MIQOT: Jurnal Ilmu-ilmu Keislaman*, *45*(1), 104-126. http://dx.doi.org/10.30821/miqot.v45i1.761.

Tambak, S., Mahfud, C., Latipah, E., & Sukenti, D. (2021). Leadership Madrasah Teachers in Teaching: The Influence of Gender and the Length of Certification of Madrasah Teachers. *Dinamika Ilmu: Jurnal Pendidikan*, *21*(2), 417-435. https://doi.org/10.21093/di.v21i2.3527.

Tambak, S., Hamzah, H., Sukenti, D., & Sabdin, M. (2021). Internalization of Islamic Values in Developing Students' Actual Morals. *JPI (Jurnal Pendidikan Indonesia)*, *10*(4), 697-709. http://dx.doi.org/10.23887/jpi-undiksha.v10i4.30328.

Tambak, S., Marwiyah, S., Sukenti, D., Husti, I., & Zamsiswaya, Z. (2023). Problem-based learning methods: Is it effective for developing madrasa teacher social competence in teaching? *Journal of Education and Learning (EduLearn)*, *17*(3), 342-353. https://doi.org/10.11591/edulearn.v17i3.20796

Tambak, S., Ahmad, M., Sukenti, D., & Ghani, A. R. B. A. (2020). Profesionalisme Guru Madrasah: Internalisasi Nilai Islam dalam Mengembangkan Akhlak Aktual Siswa. *Jurnal Pendidikan Agama Islam Al-Thariqah*, *5*(2), 79-96. https://doi.org/10.25299/al-thariqah.2020.vol5(2).5885.

Tambak, S., & Sukenti, D. (2025). Islamic professional madrasa teachers and motivation for continuous development: a phenomenological approach. *Journal of Education and Learning (EduLearn)*, *19*(1), 81-90. https://doi.org/10.11591/edulearn.v19i1.21301

Tambak, S., & Sukenti, D. (2024). Student Involvement Within Islamic Teacher Education: For a Future Profession. *QIJIS (Qudus International Journal of Islamic Studies)*, *11*(2), 317-352.

Tambak, S., & Sukenti, D. (2024). Case-Based Learning Method in Learning: Is it Effective in Improving the Teaching Skills of Madrasa Teachers in Indonesia? *Journal of Learning for Development*, *11*(1), 151-164. https://doi.org/10.56059/jl4d.v11i1.763

Tariq, M. U. (2025). Advancing Inquiry-Based Learning Through Generative AI-Enabled Assessments. In *Educational Assessments in the Age of Generative AI* (pp. 179-206). IGI Global Scientific Publishing. http://doi.org/10.4018/979-8-3693-6351-5.ch007

Tierney, G., Adams, C., & Ward, S. (2025). In the service of student engagement: Project-based learning classrooms and teacher practices. *The Journal of Experimental Education*, *93*(1), 38-53. https://doi.org/10.1080/00220973.2023.2287446

Untari, R., Kamdi, W., Dardiri, A., Hadi, S., & Nurhadi, D. (2020). The Development and Application of Interactive Multimedia in Inquiry-based learning to Enhance Students' Achievement for 2D Animation Making. *International Journal of Emerging Technologies in Learning (iJET)*, *15*(16), 17-30. https://www.learntechlib.org/p/217965/.

Wilson, K. (2021). Exploring the Challenges and Enablers of Implementing a STEM Inquiry-based learning Programme in a Diverse Junior Secondary Context. *International Journal of Science and Mathematics Education*, *19*(5), 881-897. https://doi.org/10.1007/s10763-020-10103-8.

Wu, T. T., & Wu, Y. T. (2020). Applying inquiry-based learning and SCAMPER teaching strategies in engineering education to explore the influence of creativity on cognition, personal motivation, and personality traits. *Thinking Skills and Creativity*, *35*, 100631. https://doi.org/10.1016/j.tsc.2020.100631

Yonwong, P., Thongsuk, T., & Hemtasin, C. (2024). Creativity development of secondary school students using four thinking activities blended inquiry-based learning. *International Journal of Instruction*, *17*(1), 579-598. https://doi.org/10.29333/iji.2024.17130a