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Teacher Qualification Influence on Teaching Cross-Curricular Skills: A Study Based on PISA 2015 Assessment

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Abstract
The study aims to examine the effects of educator qualifications on teaching cross-curricular skills in Korea, China due to their achievements at PISA 2015 assessments. The study indeed designed as a correlational research study. The research focuses on teacher qualifications as pre-service education and professional development in Korea and China. The sample covers teachers that are participants of PISA 2015 assessments. The data of the study was comprised of teachers' surveys that responded in Korea, and China in PISA 2015. Study revealed that teacher qualifications in Korea and China have positive influence on bringing students in cross-curricular skills that are essentials for deeper learning. The study also indicated that both pre-service teacher education and teacher professional development in service had a statistically significant effect on teaching cross-curricular skills and these are the predictors of students' successful performance in Korea, and China.
Keywords: PISA, pre-service education, professional development, teacher qualification

1. Introduction

Korea and China are two of the top performing countries according to PISA 2015 assessments. In order to dig out their success students' ability to of problem solving and critical thinking, learning to learn etc. skills becomes vital as we call them "cross-curricular skills". Since, both Korea and China are known with their sensitiveness regarding to teacher qualifications, this research was conducted to clarify whether or not teaching cross-curricular skills can be predicted by teacher qualifications as the education and professional development obtained.

The aim of the study is to investigate the teacher pre-service education and professional development during the service influences on teaching cross-curricular skills that are vital for students' success according to the results of the PISA 2015. Within the scope of this purpose, the following questions were sought:
According to PISA 2015 assessments in Korea and China:
a. At the schools where the PISA application was conducted, to what extend the ability to teaching cross-curricular skills are explained by teachers' pre-service education for both countries Korea and China?
b. At the schools where the PISA application was conducted, to what extend the ability to teaching cross-curricular skills are explained by professional development obtained in service for both Korea and China?

2. Literature Review

Teacher Training in China: Students who graduate from one of the secondary education programs may apply to the higher education, namely the teaching departments, by the examination of the central government. However, some universities in China determine their own exams and criteria themselves. For some universities, centralized examinations are sufficient, and some universities are inadequate, so they do their own examinations (Sezgin, 2008).
Pre-Service Teacher Education: Government officials and relevant departments at various levels organize teacher education and encourage youth to be trained at various levels in teacher schools. The schools that will provide teachers with advanced levels of study at different levels will undertake the task of raising teachers for primary and secondary schools. Students of Teacher Schools may benefit from professional scholarships opportunities. Governmental administrative education departments, units and schools responsible for school affairs organize teacher education programs and govern the various forms of ideological, political and vocational education among the teachers. State organs, institutions, and other social institutions shall provide them with convenience and assistance in the social investigation and social practice of teachers. Governments prefer to take measures in order to train teachers for the regions, ethnic minority groups, remote and poor regions.

A declaration issued by the Chinese central committee and the state council in 1999, introduced a system that is fully supporting the quality of education and deepening reforms in education (Sezgin, 2008). In

this context, there are various schools in Chinese education system. In order to train teachers, education faculties are not the only organization in charge. Different ways of being a teacher in China can be explained as; teacher colleges for primary school teachers (3 or 4-year), teacher college or university for secondary school teachers (4-year), teacher college or university for high school teachers (4-year), and some graduate education for high school teachers.

In order to reveal the talents of the teacher candidates, they take both branch education and educational sciences courses. Whichever branch will be a teacher, it will take all the core courses of that area and general cultural courses including Chinese culture, language and history. There is a necessity to take twelve courses of educational sciences at least one in each term.

Primary, secondary and high school teacher programs differ. Where the prospective teachers are to be employed at a certain stage, training is mainly given to that area. Students begin their internship in the last semester and are obliged to give a minimum of 40 hours of lectures. One of the other requirements of graduation is to achieve 70% success. The status of the student who has been unsuccessful in the report prepared by the adviser of the student is reviewed again by the Faculty Board. If deemed necessary, the courses that are deemed unsuccessful are given again by the advisor and the teachers. The situation repeats until obtaining positive results (Zhu and Han, 2006).

Teachers' Employment Criteria: China has stated in the 3rd part of Teachers' Law - the qualifications and employment of teachers and the institutions to which they have been given the authority to evaluate teacher qualifications in the related items of Teachers' Law. It has been stated that in 1995 the state will establish a system of qualifications for state teachers on the basis of the adopted teachers. Accordingly, in the same law, the following expression has been found.

> "*All Chinese citizens who comply with the Constitution and laws shall have the necessary educational discipline, sound ideological and moral character, possess official school enrollment prescribed in this Law or pass national teacher qualification examinations and acquire education and training proficiency, qualifications."*

In order to obtain qualifications to become a primary school teacher, the candidate must be graduated from teachers colleges or higher. Teachers who do not have formal education records, must pass the national teacher proficiency examinations in order to be satisfactory for teacher qualifications. The national teacher qualification examination system is recommended by the Council of State.

The qualifications of teachers in elementary and secondary schools are assessed and approved by the administrative education units at the district level or above the local government control.

If a citizen has the necessary formal education records for teacher qualifications as prescribed in the Law, or has passed national teacher qualification exams, he or she will be required an approval of the teaching qualifications from the relevant departments. These relevant sections will assess and give approval in accordance with the terms and conditions stipulated. Teachers who have been appointed as teachers for the first time and have sufficient qualifications will pass a trial period. States encourage university graduates who are not teacher college graduates for teaching in primary and secondary schools or vocational schools.

Schools and other educational institutions are responsible to establish a gradual assignment system for teachers. Teachers' assignments will be based on the principle of equality between the parties. The school and the teacher are signing an appointment contract defining their rights, obligations and responsibilities. The steps and measures necessary for the implementation of the teachers' appointment system are formulated by the administrative education units under the Council of State. Graduated teacher candidates start a referral in a school that the central government will set. Apart from graduation, no extra conditions are required.

Teachers' In-Service Trainings: In the in-service training of teachers, the model based on performance is preferred and lifelong education is encouraged. States establish a quality-based recruitment system, improve the quality of its teachers and promote their development through examinations, awards, training and encouragement. In relation to the evaluation of teachers, the following items are available. Schools and other educational institutions conduct evaluation of teachers' political consciousness and ideological level, assessment of professional competence, attitudes towards work and performance. Training administrative units have to guide and supervise guidance and assessment work of teachers. The evaluation is conducted objectively, fairly and correctly and in the evaluation process; their views of colleagues, students and teachers will be fully taken into consideration. The results of the evaluation are reflected on the appointment of the teachers and the salary increase, as well as the rewards and penalties.

Professional development is provided by in-service training schools for education institutes and teachers. In addition, in-service training is provided intensively through television, letter, satellite and evening schools. Successfully implemented programs in different parts of the world have adapted to the Chinese education system, in which the teacher training system has been renewed (Zhu and Han, 2006). In-service training of the class and branch teachers is given in two training, with or without grades. Teachers who have completed graded training are awarded certificates. In case of in-service training with no qualification, the

teachers are aiming to improve themselves and constitute a significant part of continuing education. Continued education is offered through programs that teachers develop their own abilities (Zhu and Han, 2006). Continued education is a program for teachers to develop their own abilities. The continued education of teachers is divided into two parts. These are; Training programs for new teachers to gain experience and Training programs for former teachers' post-training needs. Distance learning also becomes another option used for professional development in China, which began with letter training in the 1950s. Radio and television universities and colleges were established around the country towards the end of 1970's. In the 1980s, distance education started via satellite network (Sezgin, 2008).

Teacher Training in South Korea: Korea has a higher proportion than most other OECD countries of teachers under the age of 40, at both primary and secondary level, suggesting a steady supply. Prospective primary teachers must complete a four- year teacher-education curriculum and complete an entry examination. Korea has one of the steepest progressions between starting salary and salary at top of scale, with a ratio at the top of the scale of 2.8 times the starting salary for all levels from primary to upper secondary (compared to the OECD average ratio of 1.9 for primary and lower secondary and 1.8 for upper secondary). A much higher proportion of teachers in Korea than the TALIS average consider that the teaching profession is valued in society, but they report less-than-average levels of self-efficacy and satisfaction with the school in which they work. Some 63.4% of teachers say they would become teachers if they could decide again (compared to the OECD average of 77.6%).

Pre-Service Teacher Education: The teaching profession is a very popular in South Korea and is one of the most preferred professions that most students dream about. However, the Korean Ministry of National Education has developed policies and strategies to train the human profile and intellectual power is needed. The Ministry of Education is very sensitive regarding to choosing teacher candidates before giving teacher education to increase the qualifications. Thus, students who do not comply with teaching profession in terms of their ability and mathematics have initially directed themselves to different areas and have been evaluated in different areas of their different abilities.

Alike with Turkey, In the Republic of Korea, students can apply to higher education institutions by entrance examination at the end of secondary education. Evaluation of Candidates are admitted to this examination, conducted by taking into consideration the high school classroom teachers' view about student, the success of the high school final class, and the interviews conducted in the departure section and students' attitudes towards teaching in the interviews. Candidates who are passionate, talented and have a positive attitude and interest in teaching are admitted to relevant institutions.

Today, numerous universities are established to train only elementary school teachers in South Korea. There is some standardization in the programs at the education universities that are opened to train teachers (30% joint courses, 70% field lessons) to complete 150 credits for graduation. In the field of pedagogy there are eleven courses with courses in educational psychology, educational sociology, educational philosophical management (school and classroom management). In addition, several courses taught in elementary school were included in the field of pedagogy. Those are courses such as fine arts and body tricks for practical skills. More advanced courses are aimed at increasing the ability of the teacher candidate to teach lessons taught in elementary school.

Graduation thesis can also be categorized into these advanced courses. It is aimed at increasing teaching skills and making the needs of teachers more professional. The application lasts for 9 weeks and it covers applications for observation, teaching, and administrative procedures (Bakioğlu ve Baltacı, 2014). Compulsory courses in undergraduate programs especially for elementary school teacher candidates are; Humanities, Social Sciences, Natural Sciences and Body Therapy. The common and elective courses are Language and Literature, Social Sciences, Natural Sciences and Fine Arts.

While the education of teachers is mostly given in universities, the education of secondary and high school teachers is mostly given in special purpose universities and open universities. Teachers in Korea are divided into six different categories:

Level 1 teacher: Must have a level 2 certificate, teaching experience at least for three years, and have a minimum of 180 hours of certificate education. Or one year of teaching experience and have a master degree.
Level 2 teacher: Successfully completed teaching education from pre-service training institutions.
Teacher Assistant: Teacher assistance is required to pass the exam.
Advisor: Successful completion of professional counseling training.
Librarian: You must have successfully completed school librarianship training.
Practical Skill Teaching: You need to be successful in the test for practical skills teacher.
Kindergarten Teacher: To have successfully completed the necessary teacher education for the kindergarten teacher education and to have the required credits.
They must have the qualifications required for each of the teaching categories and must obtain a license from the Ministry.

Teachers' Employment Criteria: Those who have completed pre-service training and graduated receive their

certificates. If these candidates wish to work in government institutions, they will enter the written examination by ministry units. This test is based on the teacher's tendency and personality.

The exams are conducted separately for primary and secondary school teachers and consist of two stages. Each training office will determine how many positions and fill these positions according to the applicant's test results (NCEE, 2013 Mete, 2013). In South Korea, teachers need to enter a two-stage test in order to be employed. In the first stage of primary school teachers' test, the multiple-choice test is 30 points and the primary curriculum is 70 points. In the second stage, article writing is 20-25, interview 10-15 points and practice 10-70 points. Secondary education teachers' first stage of the exam education sciences multiple choice questions 30 points basic issues 70 points short answer questions. The second stage is writing articles (20-25 points), interviewing (10-15 points), classroom instruction (10-70 points) and computer knowledge (5-10 points) (Mete, 2013).

The scores are based on the points obtained from these exams. Purchases are made according to quotas. However, there is a harmony between the quota and the number of graduates. If teachers want to teach in private schools, then they apply to the institution and then they are hired in accordance with the conditions of the board of directors.

Teachers' In-Service Trainings: All the members of teaching staff (teachers, principals with different titles, and assistant principals) on the ministry side are required to have at least 30 days of in-service training in order to increase the competence of teachers and to keep up with new educational technologies and evolving innovations and become more efficient teachers. Those who are 60 hours or more educated are entering the content of this education. Teachers are being recorded due to the increase in their salaries and consideration in their education. (Bakioğlu & Baltacı, 2014). In-service training participation rates of South Korean teachers are on the rates of OECD countries (Mete, 2013).

Teacher Training Institutions are; Primary education institutes, secondary education institutes, educational administration institutes, multipurpose teaching education institutes, distance education institutions. Professional developments provided by local education departments and other institutions authorized by the Ministry in university teacher colleges (MEST, 2011). Professional development of teachers are covered by institutions as; 11 primary education institutes, 67 secondary education institutes, 1 educational administration institute, 18 multipurpose teaching institutes and 55 distance education institutes (MEST, 2011).

In the system developed to evaluate the performance of the teachers, the school principal, assistant principal, teacher colleagues, parents, and students play an effective role. With this system, the Ministry intends to ensure that the quality of the teaching profession, its professionalism is improved, and that people are trusted in teaching through fair and appropriate evaluation (MEST, 2006).

Teaching Cross-Curricular Skills: Researches prove that the students' reasoning skills improved with cross-curricular activities. This suggests that the greatest benefits were experienced when there was dedicated time to 'thinking skills', when it is given discrete curriculum time, and undertaken in an explicitly collaborative setting. This enquiry has opened many possibilities to develop our thinking skills practice further – most particularly in the ongoing design and modification of the curriculum. Problem solving, learning to learn and closer collaboration have been identified as a potential vehicle. Coupled with this, the integration of cross-curricular skills into 15-year-olds textbooks and tutor period has been identified as areas for development. The training to continue raising the profile of thinking skills also is required for student's success.

The approach has encouraged students to see how thinking skills, problem solving skills, like sorting and classifying, can enable them to approach a topic from a different angle. It also seems to help them see the transferability of such skills across their learning in a range of subjects. This could lead to a greater awareness of themselves as learners, and how they learn. Ultimately, the students were engaged and totally focused on the tasks at hand on the day itself. The workshops help teachers explicitly teach students to know what the reading strategies are, how and when to use them, and how to verbalize the strategies they are going to use to solve the reading passage facing them. Teachers of 15-year-olds science and math have received a package of templates to use before, during, and after reading to assist students in understanding informational text. The templates are related to strategies such as the following:

- "signal words", which can help students identify the type of text structure,
- use of sticky notes to flag new vocabulary, key concepts, and the places in the text where understanding breaks down,
- verbalization of obstacles and application of fix-up strategies,
- anticipation guides and concept mapping.

Subject teachers are encouraged to view reading as a problem-solving task, and to understand that students need direct instruction in reading to do it well. The workshops provide teachers with strategies to help students:

- make connections between their prior knowledge and experience and the text,
- become aware that reading informational material, like textbooks, is different from reading fiction or narrative texts.

Subject teachers are taught how to help students select and use specific reading strategies and how to help students verbalize the skills they are going to use to solve the reading passage facing them.

3. Method

The PISA Project is being implemented on a three-year basis. Coordination takes place by the OECD. PISA assessment includes the students' mathematics, science and reading skills. At the same time, PISA researches, students circumstances in the participant countries and research students' chances to learn; effected by social, political and economic development. This study was designed in a relational screening model aimed at determining the presence and / or extent of co-occurrence correlations between two or more variables. The data was obtained from PISA 2015 teacher survey. Factor analysis applied to specify teacher qualification properties. Validity checked by Cronbach's alpha level. Furthermore, multiple regression analysis applied to figure out whether or not teacher qualification predicts teaching cross-curricular skills that are required to students' academic achievement.

Factor Analysis

PISA 2015 teacher survey provided items that identify teacher qualifications. Firstly, it was observed that 14 of the 24 items correlated at least .3 with at least one other item, suggesting reasonable factorability. Secondly, the Kaiser-Meyer-Olkin measure of sampling adequacy was .84 for Korea and .78 for China, above the commonly recommended value of .6, and Bartlett's test of sphericity was significant for both Korea (χ^2 (91) = 14467.47, $p < .05$), and China (χ^2 (91) = 9017.46, $p < .05$). The diagonals of the anti- image correlation matrix were also all over .5 for each country. Finally, the communalities were all above .3. Given these overall indicators, factor analysis was deemed to be suitable with all 12 items. The factorability of the 12 items was examined. Two major factors were created as pre-service teacher education and professional development in service.

Table 1: KMO and Bartlett's Test (Korea)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.847
Bartlett's Test of Sphericity	Approx. Chi-Square	14467.473
	df	91
	Sig.	.000

Table 2: KMO and Bartlett's Test (China)

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.784
Bartlett's Test of Sphericity	Approx. Chi-Square	9017.462
	df	91
	Sig.	.000

Principal components analysis was used because the primary purpose was to identify and compute composite scores for the factors. Initial Eigen values indicated that the first two factors explained 55% for Korea and 45% for China of the variance respectively. The first and second factors had Eigen values just over one. Solutions for factors were each examined using varimax rotations of the factor-loading matrix.

A total of two items were eliminated (2 out of 14) because they did not contribute to the same factors between two countries. Factor similarity index is also calculated in order to figure out that factor one and two explains different parts of the variance. Simple factor structure is considered and items meet minimum criteria of having a primary factor loading of .4 or above, and no cross loading of .3 or above. The factor-loading matrix for this final solution is presented in Table.

The factor labels proposed by Frydenberg & Lewis (1993) suited the extracted factors and were retained. Internal consistency for each of the scales was examined using Cronbach's alpha. The alphas levels .74 for both Korea and China.

Overall, these analyses indicated that two distinct factors were underlying adolescent responses and that these factors were moderately internally consistent. Two of the fourteen items were eliminated; however, the original factor structure proposed by Frydenberg & Lewis (1993) was retained. An approximately normal distribution was evident for the composite score data in the current study, thus the data were well suited for parametric statistical analyses.

Table 3: Factor Loadings and communalities based on a principal components analysis with varimax rotation for 3 items.

	Korea			China		
Variables	Teacher Education	Professional Development	Communality	Teacher Education	Professional Development	Communality
X1		.73	.57		.73	.54
X2	.76		.63	.76		.58
X3		.75	.59		.75	.57
X4	.76		.62	.76		.58
X5		.75	.60		.75	.56
X6	.79		.64	.79		.62
X7		.73	.57		.73	.54
X8	.73		.52	.74		.55
X9		.51	.48		.51	.44
X10	.60		.54	.60		.37
X11		.55	.58		.55	.31
X12	.62		.58	.62		.40

Note: Factor loadings < .2 are suppressed.

4. Findings

Regression analysis

Regression analysis findings are explained with detailed tables shown below. Analysis findings represent that teaching cross-curricular skills (etc. problem solving, learning to learn) can be predicted by teacher qualifications for both countries Korea and China. In this study teacher qualifications are represented by the education and professional development an educator.

Korea

Table. Correlations			
		F1	F2
F1	Pearson Correlation	1	-.089**
	Sig. (2-tailed)		.000
	N	2130	2130
F2	Pearson Correlation	-.089**	1
	Sig. (2-tailed)	.000	
	N	2130	2130

**. Correlation is significant at the 0.01 level (2-tailed).

There is no significant correlation exist between factor one and factor two at the 0.05 level, which is checked by bivariate correlation analysis. . So, no multicollinearity does exist.

Table: Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.591a	.349	.348	.831

a. Predictors: (Constant), F2, F1

b. Dependent Variable: Teaching cross-curricular skills (e.g. problem solving, learning-to-learn)

Table: ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	787.243	2	393.621	570.341	.000b
	Residual	1467.950	2127	.690		
	Total	2255.192	2129			

a. Dependent Variable: Teaching cross-curricular skills (e.g. problem solving, learning-to-learn)

b. Predictors: (Constant), F2, F1

Based on the information given with three analysis above, a conclusion can be made with the table below:

Table: Korea Multiple regression results					
Prediction of teaching cross-curricular skills using teacher qualifications					
Coefficients					
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	P
(Constant)	-0.148	0.052		-2.846	0.004
F1	0.251	0.008	0.535	30.454	0.000
F2	0.168	0.01	0.303	17.269	0.000

N=2130, P <0.05

a Dependent Variable: Teaching cross-curricular skills (e.g. problem solving, learning-to-learn)

F1: Teacher Education

F2: Professional Development

There is no significant correlation exist between factor one and factor two, which is checked by bivariate correlation analysis (pearson correlation coefficient). So, no multicollinearity does exist. Since the dependent variable is continuous and has normal distribution multiple regression analysis is conducted. Multiple regression analysis was used to test if the teaching cross-curricular skills is significantly predicted by participants' qualifications.. The analysis explains 35.8% of the variance (R^2=.35, F(2,2127)=570.34, p<.05) The results of the teacher qualification indicated the two predictors explained. First indicator represents the teacher education to become able to teach at schools. Second indicator is the professional development to improve teacher qualification. It was found that teacher education significantly predicted teaching cross-curricular skills (β = .53, t(.008)=30.45, p<.05).), as did professional development (β = .30, t(.010)=17.27, p<.05).

China (Hong-Kong)

Correlations			
		F1	F2
F1	Pearson Correlation	1	.104**
	Sig. (2-tailed)		.000
	N	1841	1841
F2	Pearson Correlation	.104**	1
	Sig. (2-tailed)	.000	
	N	1841	1841

**. Correlation is significant at the 0.01 level (2-tailed).

There is no significant correlation exist between factor one and factor two, which is checked by bivariate correlation analysis at the 0.05 level. So, no multicollinearity does exist.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.490a	.240	.239	.984

a. Predictors: (Constant), F2, F1

b. Dependent Variable: Teaching cross-curricular skills (e.g. problem solving, learning-to-learn)

Anova						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	563.085	2	281.543	290.529	.000b
	Residual	1781.146	1838	.969		
	Total	2344.231	1840			

a. Dependent Variable: Teaching cross-curricular skills (e.g. problem solving, learning-to-learn)

b. Predictors: (Constant), F2, F1

Based on the information given above, a conclusion table is created for multiple regression:

Table : China Multiple regression results					
Prediction of teaching cross-curricular skills using teacher qualifications					
Coefficients					
	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	P
(Constant)	-.295	0.083		-3.536	0.000
F1	0.226	0.011	0.423	20.708	0.000
F2	0.166	0.016	0.207	10.121	0.000

N=1781, P <0.05

a Dependent Variable: Teaching cross-curricular skills (e.g. problem solving, learning-to-learn

F1: Teacher Education

F2: Professional Development

Since the dependent variable is continuous and has normal distribution multiple regression analysis is conducted. The selected analysis was used to test if teaching cross-curricular skills is significantly predicted by participants' qualifications. The results of the regression for China indicated the two predictors explained an adequate partial of the variance. First indicator represents the teacher education to become able to teach at schools. Second indicator is the professional development to improve teacher qualification. The analysis explains 24% of the variance (R^2=0.24, F(2,1781)=290.53, p<.05). It was found that teaching cross-curricular skills significantly predicted by teacher education (β = 0.42, t(0.11)= 20.71, p<.05) as by professional development (β = 0.21, t(0.16)= 10.12, p<.05).

5. Conclusion & Recommendations

Based on PISA 2015 assessmnets, Korea and China present great performance on students' achievement. One of the main reasons for the success is raising children who has cross-curricular skills as; problem solving, learning to learn, and critical thinking etc. Since, both Korea and China are known with their sensitiveness of teacher qualifications, and selections. This research was conducted to clarify whether or not teaching cross-curricular skills can be predicted by teacher qualifications as the education and professional development that obtained.

In order to maintain research, factor analysis and multiple regression analysis are applied with the data provided with PISA 2015 assessments. According to PISA 2015 assessments in Korea and China proved that, the better pre-service educated teachers have better teaching cross-curricular skills. Moreover, the more professional development they obtain in service, the more cross-curricular skills are improved. This result will affect our understanding of new teaching styles that we need in our schools.

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