# How do the reasons to become a teacher influence future secondary mathematics teachers' teaching competence and intention toward a teaching career?

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## Abstract

This study drew on data from TEDS-M and focused on whether and how the reasons to become a teacher influences future secondary mathematics teachers' mathematics-related teaching competence including mathematics content knowledge (MCK) and mathematics pedagogical content knowledge (MPCK), and the intention toward a teaching career. Based on previous research results (Hsieh et al., 2010; Hsieh, Hsieh, & Tang, 2012), we used cluster analysis to group secondary future teachers into three motivation categories according to the reasons to become a teacher, and then further analyzed and compared the performance of these types of future teachers in target variables. The results reveal that there is a significant difference on the distribution of motivation categories in different countries. For most countries, intrinsic motivation and empathy from prior learning experience have positive influence on future mathematics teachers' performance in MCK and MPCK, as well as their intention toward a teaching career.

**Keywords:** *International comparison, teaching motivation, teaching competence, teaching intention, TEDS-M*

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## Introduction

Motivation is always crucial to mathematics learning achievement, so the connection between them is frequently discussed in many studies on students' achievement or mathematics education (Eklöf, 2010; Thelk, Sundre, Horst, & Finney, 2009; Wolf & Smith, 1995). For example, Eklöf (2006, 2008) analyzed the influence of motivation upon mathematics achievement based on TIMSS data. Generally speaking, such research indicated that the more the interest or the better the learning attitude, the higher the mathematics learning achievement. Just as students are regarded as the subject in school education, so are future teachers (FTs) in teacher education system. When FTs are regarded as learners, who are learning to become a qualified teacher, will their motivation of being a teacher affect their achievement?

From the viewpoint of teacher preparation, "motivation for becoming a teacher" may affect a teacher's quality. People with particular background and characteristics may be more willing to become a teacher. In order to become a teacher, their motives may push them to devote more time and effort toward learning knowledge and skills, as well as engagement in curriculum activities in teacher education program, which further influence their competence. Hence, understanding FTs' motivation may be a key to investigate the general affective characteristics of them, and to probe into the relation between their willingness to become a teacher and their teaching competence. In addition to the relationship between motivation and achievement, teacher's motivation itself is also widely studied over the past years (Darling-Hammond, Hudson, & Kirby, 1989; Ingvarson, Beavis, Danielson, Ellis, & Elliott, 2005; Ingvarson, Beavis, & Kleinhenz, 2007; Wilson, Floden, & Ferrini-Mundy, 2001).

Teacher Education and Development Study in Mathematics (TEDS-M) is the first cross-national study of primary and secondary mathematics education sponsored and conducted by the International Association for the Evaluation of Educational Assessment (IEA), which collected and analyzed nationally representative data from participating countries (Tatto et al., 2008). Numerous investigated items were designed by TEDS-M to inspect FTs' background, opportunity to learn, belief, and mathematics-related teaching competence, which are mathematics content knowledge (MCK) and mathematics pedagogical content knowledge (MPCK). The two main items on background information in TEDS-M are concerned with the affective factors for FTs to get into the teacher preparation program, one is the reasons of becoming a teacher, which can be considered as the motivation issue; the other is about their intention toward a teaching career, which is related to the quality of career development.

Hsieh et al. (2010), based on TEDS-M data, divided the "reasons of becoming a teacher" items into three factors and portrayed these factors from the international perspective, as well as the relation among these factors and MCK/MPCK. Many interesting results were reported; some of them inspiring us to do further discussions. Based on their work, this study integrated these three factors as the basis of FT's classification. The purpose of this study is to further investigate the relations between future secondary mathematics teachers' reasons and their mathematics-related teaching competence, as well as between these reasons and their intention toward a teaching career. In light of the TEDS-M data, this study focused on the following two research questions:

1. What uniqueness, pattern or difference do future secondary teachers among different countries have about their reasons to become a teacher?
2. If there are differences among countries mentioned above, how may the differences influence future teachers' teaching competence and their intention toward a teaching career?

## Educational significance

As mentioned in the previous section, a number of researches investigated the issue related to teachers' backgrounds or teaching competence, but most of them focused on a single country. It is not common to see cross-national data, and we believe that by advanced analyzing IEA data base, this research has offered at least the following educational significances:

1. A number of researches have shown that motivation is the significant factor influencing performance. However, there are few researches that are devoted to conducting a survey of the relation between teachers' motivation to become a teacher and teachers' teaching competence.
2. Some researchers investigated the reasons to become a teacher for future mathematics teachers (for example, Darling-Hammond, Hudson, & Kirby, 1989), but most of the studies were limited within one country. From international perspectives, data and results are actually rare at present.
3. Some researchers surveyed how FTs perceive their teaching career (for example, Hsieh et al., 2010). Darling-Hammond, Chung, & Frelow (2002) found that teachers' views of teaching as an occupation are strongly related to how well prepared they felt when they entered (p. 294). By probing into the relation between reasons to become a teacher and their intention of a lifetime career, this study can provide information to help us understand the career intention of future teachers in advance.

## Theoretical framework and research methods

Generally speaking, different types of motivation hide behind a period of good learning or performance. It is thought that intrinsic motivation toward doing a work is preferable over extrinsic ones, could a well-intrinsically-motivated future teacher put more effort into his/her teaching and show better teaching competence? Hsieh et al. (2010), from international perspectives, identified some factors that motivate future teachers to become a teacher. They found that, in the lower secondary level, there are no explicit correlations between all those factors and FTs' MCK and MPCK performances, except a weak negative correlation between the factor of intrinsic motivation and MCK (Hsieh *et al*, 2010). These results interested us enormously. Due to the lack of explicit relationships between individual motivation factor and the outcomes of teacher preparation in the above analysis, this paper tried to combine or integrate some of these factors that emerged from factor analysis and then investigate the

connection between the reasons to become a teacher and future teachers' learning outcomes such as MCK/MPCK.

Basically the methods and target database of this paper were drawn from the TEDS-M study, whose research design including methodology and data collection were developed, administrated and controlled under the aegis of IEA (Tatto et al., 2008). The target population is future secondary mathematics teachers in their final year of training. The factor-structure of their reasons to become a teacher had been identified as including at least three major factors, which were labelled "*intrinsic motivation*", "*empathy from prior learning experiences*", and "*salary and job security*" (Hsieh, Hsieh, & Tang, 2012; Hsieh, Wang, et al., 2010). These factors explained almost sixty percent of the variation (Hsieh, Hsieh, & Tang, 2012). Some reasons can be explained mainly by the first factor such as enjoy working with young people or hoping to influence the next generation. The next factor is mainly employed to explain other reasons like "I was always a good student in school" or "I love mathematics". These reasons are different from the others explained by the last factor representing some extrinsic motives. Teacher salaries, the availability or security of teaching positions become the foci of extrinsic motivation. Each factor represents an approach or an inclination of perceiving the relation between the mathematics-teaching job and individuals.

Furthermore, the study built three scales for scoring the extent of future teachers' inclination from the above factor-approaches by using the software Winsteps (v.3.69.1.13), with the partial-credit model. When calibrating the items for each of the scales, cases with 50% or more missing responses on the items were excluded from the analysis. Although there are not many items for each scale (4 items for *intrinsic motivation*, 3 items for *salary and job security*, and 2 items for *empathy from prior learning experiences*), the criterion is necessary for ensuring validity. In addition, the sampling weights were transformed linearly so that the sum of the weights by country was equal. By means of using these linearly transformed sampling weights in the calibration, each country contributed equally to the calibration and analysis of each scale. Finally, the Rasch logit scores of each scale were transformed to make the value of 10 represent the neutral tendency by Winsteps: a value above 10 means the tendency to accept the reasons of becoming a teacher for that scale and a value below 10 means the opposite tendency.

Additionally, the study used K-Means clustering method (one of cluster analysis methods) to group the future teachers according to their Rasch logit scores in three scales. The future teachers are classified into three clusters and Table 1 presents the results of analysis. Cluster 1 is labeled "*Low salary-and-job-security attraction* (LSSA)", because the mean of salary and job security is below the value of 10, and also because the mean of the three scales in this cluster is the least in the three clusters. In the other clusters, the one labeled "*High intrinsic and high empathy* (HIHE)" possesses the highest mean in the scale of *empathy from prior learning experiences*, while the other labeled "*High intrinsic and medium empathy* (HIME)" possesses the highest mean in the scale of *intrinsic motivation*. For becoming a teacher, the LSSA cluster tends to reject the reasons of salary and job security, and the other clusters tend to accept all the reasons. But the HIME cluster tends to adduce reasons according to their

intrinsic motivation, while the HIHE cluster likes to adduce more reasons related to empathy from their prior learning experiences.

Table 1. Final cluster canters of three motivation scales

| Cluster / sample size | Cluster 1 (n=2642) | Cluster 2 (n=3468) | Cluster 3 (n=1584) | F Sig. |
|---|---|---|---|---|
| Title of cluster | LSSA | HIME | HIHE | |
| Intrinsic motivation | 11.605 | 13.256 | 13.153 | 1105.045*** |
| Salary and job security | 9.613 | 11.844 | 11.716 | 2141.385*** |
| Empathy from prior learning | 11.047 | 12.402 | 15.932 | 8695.772*** |

LSSA= low salary-and-job-security attraction; HIME= high intrinsic and medium empathy; HIHE= high intrinsic and high empathy.
*** $p < .001$.

In TEDS-M, the future teachers' intentions toward a teaching career were also investigated. The item consists of five options, including "I expect it to be my lifetime career", "It could possibly be my lifetime career", "It is something I can do until I find the career that I really want", "I will probably not seek employment as a teacher", and "I don't know". These alternatives present a spectrum of intentions toward a teaching career from positive to negative. For example, the first alternative indicates a positive and intrinsic view toward a teaching career and the third indicates a less favored, neutral view toward a teaching career, which regards teaching as an option of transition jobs (Hsieh et al., 2010). Nevertheless, the intention may be looked as an important outcome of teacher preparation based on the purpose or meaning of most teacher education. Therefore the study investigates the relation between reasons for becoming a teacher and future teachers' learning outcomes including their MCK/MPCK and their intention toward a teaching career. The framework of this study is presented as Figure 1.

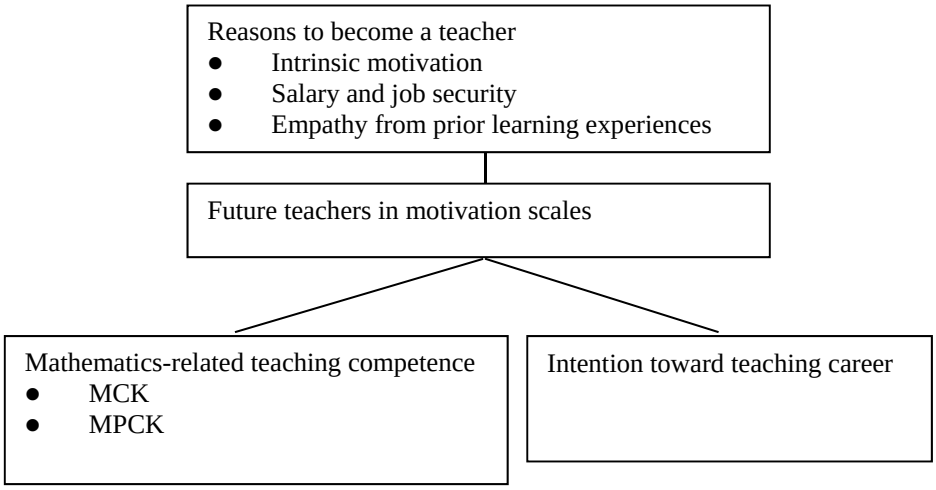


Figure 1. The framework of this study

# Results

## MOTIVATION CATEGORIES OF FUTURE TEACHER IN BECOMING A TEACHER

There are three motivation categories considered in this study. The characteristic of LSSA is that the mean of *salary and job security* is relatively low; in other words, the FTs in this group are relatively not attracted by the salary or job security (extrinsic motivation) of the teaching job. However, their scores in *intrinsic motivation* and *empathy from prior learning experiences* are slightly above the value of 10 representing the neutral tendency, which means these two factors are not their main motives to become a teacher. It indicates that there might be other reasons that are not mentioned in the TEDS-M questionnaire. For example, Hsieh et al. (2010) figured out that one of the other main factors for FTs in Taiwan is: *stable and independent lifestyle*, such as "work independently" and "daily schedule is stable". TEDS-M research condensed the information provided by the NRCs of participating countries in the categories of jobs, careers, and working conditions and organized them under the following indicators: teacher employment systems, teacher working conditions, teacher salaries and incentives, and teacher supply and demand (Tatto et al., 2012). If the proportion of LSSA is high in one country, which means high proportion of FTs are not attracted by salary and job security, then there might be a low job security, bad working condition, low salary for a teacher, or low teacher demands in that country.

HIME and HIHE are both slightly above neutral 10 in salary and job security, but high in intrinsic motivation; namely, FTs in these two clusters may put more effort into becoming a teacher. The main difference between the two clusters is in the scale of empathy from prior learning experiences (hereafter referred to as "Empathy"), which indicates that FTs transfer their past positive learning experience into becoming a teacher. In other words, FTs in HIHE not only possess high intrinsic motivation, but are also willing to pass their good experiences on to students. As for FTs of HIME, their score in Empathy is only slightly above neutral 10, which is probably due to their lack of good learning experiences, or the good learning experiences were not transferred to students as it is not their reason for not becoming a teacher. From a national viewpoint, a higher proportion in HIME or HIHE represents a higher proportion of FTs with high intrinsic motivation in that country. Furthermore, a higher proportion in HIHE also reflects the tendency of transforming positive learning experiences into teaching career.

Table 2 shows the numbers and percentages of the three motivation categories for all TEDS-M countries, revealing an obvious difference on the proportion of motivation categories from country to country. For most countries, the highest proportion is in HIHE or HIME, except for Chile, Poland and Russia. Although the highest proportion motivation category is not LSSA in Taiwan, Singapore, and Norway, but there is more than one-third of the proportion in LSSA. This means that a high proportion of FTs in these six countries mentioned above are not attracted by the salary and job security of a teaching job or teacher supply to become a teacher. In general, all countries are categorized into five types by this study: (1) The proportion of FTs in LSSA is extremely higher than the rest, such as Poland and Russia, (2) The proportion of FTs in HIME is extremely higher than the rest, such as

Germany, Switzerland, Thailand, and the United States, (3) The proportion of FTs in HIHE is extremely higher than the rest, Oman is the only country that shows the pattern in TEDS-M study, (4) The proportions of FTs in both LSSA and HIME are extremely higher than the rest, such as Chile, Norway, Singapore and Taiwan, (5) The proportions of FTs in both HIHE and HIME are extremely higher than the rest, including Malaysia and the Philippines. We will further discuss this in the next section.

Table 2. Number and percentage of the three motivation categories for all TEDS-M countries

| | n | | | % | | |
|---|---|---|---|---|---|---|
| Country | LSSA | HIME | HIHE | LSSA | HIME | HIHE |
| Botswana* | 1 | 9 | 10 | 4.81 | 45.31 | 49.87 |
| Chile | 976 | 949 | 78 | 48.72 | 47.37 | 3.91 |
| Georgia* | 19 | 20 | 20 | 31.84 | 33.52 | 34.65 |
| Germany | 611 | 2056 | 694 | 18.19 | 61.17 | 20.64 |
| Malaysia | 94 | 269 | 227 | 15.94 | 45.56 | 38.49 |
| Oman | 34 | 65 | 149 | 13.87 | 26.10 | 60.03 |
| Norway | 744 | 1180 | 139 | 36.06 | 57.21 | 6.73 |
| Philippines | 398 | 1282 | 976 | 14.99 | 48.27 | 36.74 |
| Poland | 790 | 328 | 204 | 59.78 | 24.83 | 15.39 |
| Russia | 3224 | 1544 | 965 | 56.24 | 26.93 | 16.83 |
| Singapore | 152 | 204 | 70 | 35.68 | 47.93 | 16.39 |
| Switzerland | 19 | 124 | 33 | 11.02 | 70.19 | 18.79 |
| Taiwan | 156 | 193 | 25 | 41.70 | 51.65 | 6.65 |
| Thailand | 190 | 859 | 300 | 14.09 | 63.68 | 22.23 |
| United States | 1365 | 2953 | 1225 | 24.62 | 53.28 | 22.11 |
| Int. Average | 8774 | 12035 | 5115 | 28.50 | 46.87 | 24.63 |

LSSA= low salary-and-job-security attraction; HIME= high intrinsic and medium empathy; HIHE= high intrinsic and high empathy. *65.37% and 53.02% of the sampls in Botswana and Georgi, respectively, fail to respond to 60% (and above) of the questions, at least 6 questions. These two countries are excluded from this analysis. The colored cell means the proportion of the category which is more than one-third in that country.

## Relation Between Motivation Categories and MCK & PCK

In the above section, we identified three motivation categories that motivated future teachers to become a teacher: LSSA, HIME, and HIHE. Are future teachers' MCK and MPCK also influenced by these motivation categories?

Table 3 and Table 4 show the achievements of FTs of three motivation categories in MCK and MPCK. For MCK, either HIME or HIHE has the highest score for every country. For MPCK, the highest one falls in either HIME or HIHE, except in Malaysia and Singapore. In most countries, FTs with high intrinsic motivation (HIHE, HIME) perform better than those in LSSA on MCK and MPCK. And such a trend is also reflected by the international average. This research further found that the highest score, for MCK, locates on HIHE in ten countries, which means that besides intrinsic motivation, Empathy also benefits the performance of MCK. For MPCK, though the highest score falls on HIHE in most countries, the number has decreased to six countries.

This research further adopted ANOVA analysis and found that for MCK, the average of the three categories is significantly different in ten countries. Under multiple comparisons analysis (with LSD approach), the performance of FTs of HIHE is significantly better than those of LSSA in seven countries, and HIME is significantly better than LSSA in six countries. (see Table 3) In other words, low salary and job security attraction and lower intrinsic motivation will have a negative influence on FT's performance on MCK. Most particularly, nine countries show significant difference between HIHE and HIME, and eight of them (except Russia) showed Empathy as having a more positive influence on MCK than intrinsic motivation. As for MPCK, the averages of the three categories in nine countries are significantly different. With multiple comparisons analysis (see Table 4), the performance of FTs of HIHE is significantly better than those of LSSA in six countries, and HIME is significantly better than LSSA in four countries. We can tell that the influence of low external motivation and low intrinsic motivation on FT's performance on MPCK is not as much as it is on MCK. As for the comparison between HIHE and HIME, HIHE is significantly better than HIME in six countries. Therefore, Empathy also has more positive influence on MPCK than intrinsic motivation.

Table 3. The MCK performance of FT in different motivation categories for all TEDS-M countries

| Country | Total[a] | LSSA | HIME | HIHE | F Sig. | Multiple comparisons |
|---|---|---|---|---|---|---|
| Botswana | 440.19 | 469.20 | 435.81 | 441.37 | - | - |
| Chile | 358.08 | 352.84 | 364.15 | 349.83 | 5.269** [b] | 1-2, |
| Georgia | 459.20 | 439.19 | 484.59 | 453.02 | - | - |
| Germany | 520.42 | 489.70 | 521.70 | 543.66 | 57.678*** | 1-2, 1-3, 2-3 |
| Malaysia | 493.69 | 490.11 | 487.29 | 502.76 | 6.071** | 1-3, 2-3 |
| Norway | 445.42 | 434.07 | 448.11 | 484.99 | 34.009*** [b] | 1-2, 1-3, 2-3 |
| Oman | 474.69 | 461.53 | 469.98 | 479.78 | 2.848 | |
| Philippines | 442.84 | 429.61 | 443.22 | 447.75 | 16.237*** [b] | 1-2, 1-3, 2-3 |
| Poland | 540.23 | 536.34 | 541.20 | 553.80 | 6.912** [b] | 1-3, 2-3 |
| Russia | 594.45 | 588.05 | 609.37 | 591.98 | 23.904*** [b] | 1-2, 2-3 |
| Singapore | 571.22 | 568.29 | 571.00 | 578.26 | .649 | |
| Switzerland | 531.06 | 528.96 | 525.36 | 553.57 | 4.283* | 2-3 |
| Taiwan | 667.30 | 664.26 | 671.77 | 651.78 | .990 | |
| Thailand | 479.33 | 471.40 | 476.31 | 492.98 | 11.161*** | 1-3, 2-3 |
| United States | 505.26 | 489.64 | 501.75 | 531.56 | 130.246** | 1-2, 1-3, 2-3 |
| Int. Average | | 494.21 | 503.44 | 510.47 | | |

LSSA= low salary-and-job-security attraction; HIME= high intrinsic and medium empathy; HIHE= high intrinsic and high empathy. 1, 2, and 3 in "Multiple comparisons" column indicate LSSA, HIME, and HIHE, respectively.
[a] The score is computed with effective sample size. [b]Equal variances not assumed, substitute F(sig.) with statistics of Rubust tests of equality of means (Welch). A dash (-) indicates that country is excluded from the analysis due to small sample size. The colored cell means the highest score in affiliated country and significantly different from another category.
*$p$ < .05. **$p$ < .01. ***$p$ < .001.

Table 4. The MPCK performance of FT in different motivation categories for all TEDS-M countries

| Country | Total[a] | LSSA | HIME | HIHE | F Sig. | Multiple comparisons |
|---|---|---|---|---|---|---|
| Botswana | 433.59 | 426.51 | 426.63 | 440.60 | - | - |
| Chile | 397.42 | 389.93 | 404.95 | 399.50 | 7.465** [b] | 1-2 |
| Georgia | 463.30 | 455.22 | 453.83 | 479.89 | - | - |
| Germany | 541.32 | 533.91 | 540.84 | 549.26 | 4.161* [b] | 1-3, 2-3 |
| Malaysia | 472.39 | 483.66 | 468.41 | 472.43 | 2.131 | |
| Norway | 463.33 | 459.83 | 462.66 | 488.66 | 6.532** [b] | 1-3, 2-3 |
| Oman | 474.81 | 446.97 | 463.01 | 486.37 | 6.331** | 1-3, 2-3 |
| Philippines | 451.86 | 444.33 | 454.87 | 450.98 | 3.962* [b] | 1-2 |
| Poland | 525.22 | 526.10 | 515.58 | 537.05 | 5.286** | 2-3 |
| Russia | 567.54 | 563.25 | 574.26 | 571.11 | 7.764*** | 1-2, 1-3 |
| Singapore | 553.12 | 557.05 | 552.96 | 545.10 | .360 [b] | |
| Switzerland | 549.00 | 538.58 | 550.40 | 549.90 | .226 | |
| Taiwan | 649.50 | 647.39 | 653.78 | 629.52 | .785 | |
| Thailand | 476.57 | 474.72 | 473.48 | 486.59 | 4.739** | 1-3, 2-3 |
| United States | 502.45 | 489.51 | 500.64 | 521.52 | 56.376*** [b] | 1-2, 1-3, 2-3 |
| Int. Average | | 495.80 | 499.75 | 507.23 | | |

LSSA= low salary-and-job-security attraction; HIME= high intrinsic and medium empathy; HIHE= high intrinsic and high empathy. 1, 2, and 3 in "Multiple comparisons" column indicate LSSA, HIME, and HIHE, respectively. [a] The score is computed with effective sample size. [b]Equal variances not assumed, substitute F(sig.) with statistics of Rubust tests of equality of means (Welch). A dash (-) indicates that country is excluded from the analysis due to small sample size. The colored cell means the highest score in affiliated country and significantly different from another category.
*$p$ < .05. **$p$ < .01. ***$p$ < .001.

## RELATION BETWEEN MOTIVATION CATEGORIES AND THE INTENTION TOWARD A TEACHING CAREER

In Hsieh et al. (2010), the authors show how FTs perceive their teaching career through international comparison. This study wants to find out whether FT's intention toward teaching would be influenced by their motivation categories. Table 5 shows the percentage of five teaching intention items for three motivation categories. After comparing the international average, we found that the FTs of HIHE, who chose the item "I expect it to be my lifetime career" (hereafter referred to as "EXPECT"), has the highest proportion in the three motivation categories. By focusing on the item EXPECT and using cross-categorical within one country, the percentage of EXPECT in HIHE is higher than that in HIME and LSSA in eleven countries, excluding Norway and Switzerland (see Table 5, the underlined numbers). In many countries, including Germany, Oman, the Philippines, Poland, Taiwan and Thailand, the proportion of EXPECT increases massively with increase of intrinsic motivation and Empathy.

By observing the data with-in categories in Table 5, this study found that in LSSA, only four countries show the highest proportion in EXPECT; as well as five countries and nine

countries in HIME and HIHE, respectively. By adding EXPECT and "COULD BE" (meaning "It could possibly be my lifetime career") together, there are only six countries in which over 80% of the FTs in LSSA checked one of the two items; but for the FTs in HIHE and HIME, eight and ten countries exceeded 80% respectively. These results revealed that for most of the countries, FTs with high intrinsic motivation and high Empathy tend to regard teaching job as a lifetime career.

Relatively, by focusing on the item "regard the teaching job as something I can do until I find the career that I really want" ("UNTIL WANT"), we found that there are five countries in which over 20% of the FTs in LSSA chose this; but for HIME and HIHE, there are three and two countries respectively. For some countries, like Oman and Taiwan, the proportion of UNTIL WANT decreases massively with increase of intrinsic motivation and Empathy. However, for other countries, like the Philippines and Poland, the proportion of this item does not drop from LSSA to HIME, but drops tremendously from HIME to HIHE. This means that Empathy has an influence on regarding a teaching job as a temporary job in these two countries, but intrinsic motivation does not. Another interesting result is in Switzerland, where there is a great increase to 32.8% from HIME to HIHE in the item UNTIL WANT, while in Russia, 40.5% of the FTs in LSSA chose "I will probably not seek employment as a teacher" ("NOT SEEK").

## Discussion and conclusion

The results in this study reveal that there is an obvious difference in different countries on the distribution of the three motivation categories and that these differences affect future teachers' performance in MCK and MPCK directly, as well as their intentions toward a teaching career. We believe that these results offer a number of new evidence which also gives us some reflections on teacher education.

In general, countries in motivation categories can be categorized into five types. Poland and Russia have a high proportion in LSSA (but low in others), which means that most FTs in these countries choose to become a teacher not because of salary and job security. In the reports of TEDS-M by Tatto et al. (2012), Poland provides teachers with low salaries, and an oversupply of job openings, which may be one of the reasons for this phenomenon. Germany, Switzerland, Thailand, and the United States belong to another type, which has over 50% of the FTs in HIME (but low in others). FTs in these countries have intrinsic motivation to become a teacher, but Empathy is only slightly above average. Thus, past learning experience is not one of the main reasons for them to become a teacher. Oman is the only country that shows high HIHE (but low in others) pattern in TEDS-M countries. Most FTs, in Oman, do not only have high intrinsic motivation but also high Empathy. The fourth type is the country with high LSSA and HIME (but low HIHE), including Chile, Norway, Singapore and Taiwan. About half of the FTs in these countries choose to become a teacher due to intrinsic motivation; more than one-third (Chile even reached 48.72%) of these FTs are not attracted to the salary and job security. For Taiwan, it may be due to the oversupply of applicants and the fully qualified teachers without jobs (Tatto et al., 2012). Malaysia and the Philippines form

the fifth type with high HIHE and HIME. A high proportion of FTs choose to become a teacher because of intrinsic motivation, but around 40% of the FTs choose to become a teacher because of Empathy.

The results in Hsieh et al. (2010) showed that there are no explicit correlations between the reason factors, which they identified with FTs' MCK and MPCK, except a weak negative correlation between the factor of intrinsic motivation and MCK. It seems that intrinsic motivation does not benefit MCK and MPCK, which contradicts the general idea that intrinsic motivation helps achievement. According to the results in this paper, intrinsic motivation and Empathy have a positive influence on MCK and MPCK in most countries, and the influence of Empathy is even greater than that of intrinsic motivation. One possible reason why our result is different from Hsieh et al. is that they processed cross-country comparison between a single reason factor and a whole country's MCK or MPCK. This study categorized FTs from 13 countries based on reason factors, and compared MCK/MPCK of FTs from different categories, which helped us exclude the differences among countries and proceed within country comparison in which the reason factors can be revealed. Thus, it is found that the difference of competence among countries exceed the difference of reason factors, which make the results of the two studies different.

Another value of this study is that integrating three factors make our study focus on the FTs, instead of individual factors, and the results help teacher preparation system when recruiting or training FT. For example, for those countries where FTs of HIHE perform better than those of LSSA, they can raise the proportion of HIHE as much as possible when recruiting FTs, or use the criteria of HIHE to recruit FTs. In most countries, FTs of HIHE perform significantly better than those of HIME or LSSA in MCK. For example, the average of HIHE exceeds LSSA by over 50 points (half of one standard deviation) in Germany and Norway, and over 40 points in the United States. Therefore, with the same conditions, these countries can raise their quality greatly on MCK by recruiting FTs of HIHE. This comparison also provides an alternative-viewpoint analysis, such as the score of HIHE for the United States and Germany which exceeds the overall average of Switzerland's, and even excels Poland's. Although the overall average of Germany is greater than that of the United States, they have almost the same score in LSSA. Moreover, the differences within motivation categories in MPCK are smaller than those in MCK, which indicates the smaller influence of motivation upon MPCK. The reason why the influence upon MPCK is smaller than that on MCK, and why the influence of Empathy is greater than intrinsic motivation, are worth analyzing.

It is understandable then a teacher is more willing to devote him/herself to teaching and also to learning applicable information if he/she takes it as a lifelong career. We believe that if the FT only takes teaching as a temporary job, one's willingness to fit into the teaching environment is low. On the other hand, if the teacher preparation system cultivates a FT with a large amount of resources, while he/she is not going to become a teacher or only takes teaching as a temporary job, then it would be a waste of education resource. In this paper, we found that for most of countries, the proportion of FTs who regard teaching as their lifelong career is higher in HIHE than in the other two categories. We also found that the proportion of FTs who regard teaching as a temporary job is higher in LSSA than the other two categories.

In countries with high proportion of HIHE or HIME, the waste of teacher preparation resources can be reduced so that FTs are more willing to devote him/herself to teaching and learning.

Last but not least, from the viewpoint of teaching competence or intention toward the future, if a teacher preparation system would like to promote the quality of FT's, increase their teaching intentions, avoid wasting education resources, then increasing the proportion of HIHE would be a good strategy. In other words, in order to expect all FTs to have better performance, the teacher preparation system needs to ensure that their FTs can gain higher intrinsic motivation. A better recruiting method will be needed to raise the empathy from prior learning.

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Table 5. Percentages of FT in teaching intention in different motivation categories for all TEDS-M countries

| Motivation categories | LSSA | | | | | HIME | | | | | HIHE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Country | EXPECT | COULD BE | UNTIL WANT | NOT SEEK | DO NOT KNOW | EXPECT | COULD BE | UNTIL WANT | NOT SEEK | DO NOT KNOW | EXPECT | COULD BE | UNTIL WANT | NOT SEEK | DO NOT KNOW |
| Botswana[a] | | | 100.0 | | | 40.59 | 11.88 | 11.88 | | 35.65 | 43.88 | | 34.18 | | 21.94 |
| Chile | 64.42 | 26.00 | 5.33 | 0.63 | 3.62 | 70.87 | 23.45 | 4.18 | 0.36 | 1.14 | 79.48 | 20.52 | | | |
| Georgia[a] | 7.96 | 8.25 | 8.25 | 29.14 | 46.40 | 10.06 | 16.62 | 17.83 | 8.75 | 46.74 | 13.66 | 7.09 | 28.98 | 24.67 | 25.59 |
| Germany | 23.44 | 60.47 | 3.61 | 2.49 | 9.98 | 40.07 | 53.23 | 1.61 | 1.01 | 4.08 | 54.58 | 38.54 | 1.33 | 1.27 | 4.27 |
| Malaysia | 56.95 | 31.28 | 6.98 | 1.31 | 3.48 | 57.53 | 27.40 | 9.24 | 2.21 | 3.61 | 63.85 | 26.10 | 6.21 | 0.54 | 3.29 |
| Norway | 25.29 | 55.32 | 5.58 | 3.25 | 10.56 | 21.97 | 64.42 | 5.91 | 1.19 | 6.51 | 23.88 | 64.06 | 6.06 | 2.36 | 3.64 |
| Oman | 20.83 | 25.94 | 29.49 | 8.12 | 15.63 | 35.30 | 39.43 | 9.76 | 6.04 | 9.47 | 57.71 | 26.49 | 6.66 | 2.48 | 6.66 |
| Philippines | 16.78 | 44.43 | 26.60 | 1.27 | 10.93 | 32.58 | 33.55 | 26.35 | 2.80 | 4.72 | 47.38 | 37.51 | 11.86 | 2.50 | 0.76 |
| Poland | 8.39 | 33.20 | 27.46 | 23.13 | 7.82 | 27.47 | 38.56 | 28.06 | 4.35 | 1.56 | 45.13 | 26.42 | 19.97 | 4.67 | 3.81 |
| Russia | 2.76 | 18.25 | 23.43 | 40.54 | 15.02 | 8.15 | 46.11 | 23.13 | 14.41 | 8.20 | 9.31 | 38.98 | 25.40 | 20.58 | 5.74 |
| Singapore | 15.29 | 58.14 | 6.49 | 2.08 | 18.01 | 21.17 | 64.30 | 2.88 | 0.66 | 10.99 | 31.06 | 55.96 | 6.48 | | 6.50 |
| Switzerland | 5.16 | 76.76 | 6.09 | | 11.99 | 9.66 | 70.18 | 8.92 | | 11.24 | 7.76 | 54.35 | 32.80 | 5.09 | |
| Taiwan | 30.88 | 38.26 | 24.33 | 4.57 | 1.96 | 65.13 | 20.30 | 14.57 | | | 71.18 | 20.77 | 8.04 | | |
| Thailand | 39.23 | 34.38 | 6.15 | 15.87 | 4.38 | 47.95 | 40.60 | 4.99 | 2.79 | 3.67 | 70.02 | 25.07 | 2.81 | 1.40 | 0.69 |
| United States | 63.42 | 30.24 | 1.43 | 3.79 | 1.13 | 59.07 | 32.19 | 1.87 | 4.21 | 2.66 | 70.93 | 27.44 | 0.47 | | 1.16 |
| Int. Average[b] | 28.68 | 40.97 | 13.31 | 8.23 | 8.81 | 38.22 | 42.59 | 10.88 | 3.08 | 5.22 | 48.64 | 35.55 | 10.67 | 3.41 | 3.04 |

LSSA= low salary-and-job-security attraction; HIME= high intrinsic and medium empathy; HIHE= high intrinsic and high empathy.

"EXPECT"= I expect it to be my lifetime career; "COULD BE"= It could possibly be my lifetime career; "UNTIL WANT"= It is something I can do until I find the career that I really want; "NOT SEEK"= I will probably not seek employment as a teacher.

[a] Indicates that country is excluded from the analysis due to small sample size. [b] The score is computed without Botswana and Georgia. The colored cell means the highest percentages with-in categories in the participant country. The underlined numbers mean the highest percentages in "EXPECT" column for cross-category comparison in the participant country.