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How Gender Stereotypes Influence Female High School Students in Japan in Their Path

Choice: A Systematic Review

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PAMAOW05: Master's Thesis (20ECTS)

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June 1st, 2023

Word Count: 5959

Abstract

This thesis aims to systematically review which factors have already been identified that can reduce gender stereotype influence on path choices that female high school students in Japan make. According to the Organization for Economic Cooperation and Development (OECD), Japan has the lowest ratio of female bachelor graduates in the fields of science, technology, engineering, and mathematics (STEM) among the OECD countries. In this study, a systematic review was conducted on the previous literature investigating the influence of gender stereotypes on female high school students in Japan in their path choice. From the first selection of 312 papers, eight papers were included in the analysis. Based on the analysis, students' values and beliefs, teachers, parents, and other surroundings were found as factors to influence how gender stereotypes affect female students' path choices. In conclusion, three factors which can contribute to reducing the influence of gender stereotypes on female students' path choice were suggested; (1) enhancing female students' non-stereotypical values and beliefs, (2) increasing opportunities for female students to know and/or meet role models, and (3) providing information about the current situation of female workers in STEM fields to students, parents, and teachers.

Keywords: gender stereotypes, path choice, high school, female students, STEM

How Gender Stereotypes Influence Female High School Students in Japan in Their Path Choice: A Systematic Review

According to the Organization for Economic Cooperation and Development (OECD), Japan has the lowest ratio of female bachelor graduates in the fields of science, technology, engineering, and mathematics (STEM) among the OECD countries (OECD, 2017). Takami & Ozawa (2022) pointed out that one of the reasons for this gender gap is related to gender stereotypes which students have been exposed to during their education. According to Collins COBUILD Advanced Dictionary of English, a stereotype is a “fixed general image or set of characteristics that a lot of people believe represents a particular type of person or thing” (Cobuild, 2012). Thus, gender stereotypes are a set of characteristics which are associated with a specific gender. Morinaga (2017) mentions that gender stereotypes such as the belief that women cannot do math can influence the path choice that high school students make. In Japan, students have to choose the path between science-oriented or humanities-oriented at the high school¹ level, which will eventually restrict the fields that students can pursue in their post-secondary education. Takami & Ozawa (2022) found that not only students’ grades in each subject or their interests but also gender stereotypes that people around them hold have an impact on the path choice they make.

The Office of the High Commissioner for Human Rights (OHCHR) states that “a gender stereotype is harmful when it limits women’s and men’s capacity to develop their personal abilities, pursue their professional careers and/or make choices about their lives” (OHCHR, n.d.). As prior studies (e.g., Morinaga, 2017; Takami & Ozawa, 2020) found that gender stereotypes in education might have a restrictive impact on students’ path choice, they can be considered “harmful”. Therefore, interventions aimed at reducing gender stereotypes

¹ High school in Japan is an institution for upper secondary education, which is equivalent to 10th to 12th grades, and the age range of the students is mainly between 15 to 18 (MEXT, n.d.). High school in Japan is not compulsory, but 98.8 percent of students enroll in high school (MEXT, 2021).

are crucial particularly for female students, who have shown to be more affected by gender stereotypes than male students (Inoue et al., 2021).

This thesis aims to systematically review which factors have already been identified that can reduce gender stereotype influence on path choices that female high school students in Japan make. By identifying these factors and analysing them, the present contribution has as its objective to provide a better understanding of which factors are effective in combatting the influence that gender stereotypes have on female students.

Path Choice in Japanese High Schools

Ministry of Education, Culture, Sports, Science and Technology (MEXT) reports that in Japan, 98.8% of children at the age of 15 in April proceed to higher secondary education, and 73.1% participate in general courses² of high school, where they usually choose the “path” in the first year (MEXT, 2021). There are two options from which students can choose: humanities and science. Those who want to learn more about literature and social science are supposed to choose the humanities path. Conversely, those who are interested in mathematics and science are expected to choose the science path. For those who will attend university after graduating from high school, since each path has a predetermined set for the students in it to learn, the path they have chosen determines which academic fields they can apply to. In other words, if a student chooses the humanities path in high school, he or she cannot acquire the mastery of math and science good enough to pass the university entrance exams for majors in STEM fields.

When looking at the distribution of male and female high school students’ path choices in Japan, there is an apparent gap. According to the National Institute for Educational Policy Research (NIER), among the high school students participating in the courses where

² High school courses in Japan are divided into three categories: general, specialized, and integrated courses. The aim of general courses is to “provide mainly general education suited to the needs of both those who wish to advance to higher education and those who are going to get a job but have chosen no specific vocational area.” (NIER, 2012b)

they need to choose the path, 32% choose the science path and 68% choose the humanities path (NIER, 2012a). Among male students, the science path is chosen by 42% of them and 58% choose the humanities path, whereas only 23% of female high school students choose the science path and 77% choose the humanities path (NIER, 2012a). These figures show that female students are less likely to choose the science path compared to their male counterparts.

State of the Art

Previous studies have revealed how gender stereotypes can influence students, especially female students. Some studies showed the influence of parents' gender stereotypes on their daughters' ability in mathematics, self-efficacy, and career choice (Bleeker & Jacobs, 2004; Jacobs & Eccles, 1992). Teachers are also reported to affect female students' attitudes towards scientific subjects and scores, which thus foster stereotypes within those students that women cannot do mathematics (Beilock et al., 2010; Morinaga et al., 2017; Spencer et al., 1999).

The reasons behind the gender gap in the number of students in the STEM fields have also been studied. Eccles (2007) reported that gender stereotypes associated with different occupations influence students' educational decisions. Carnell et al. (2010) explored the effects of role models and showed that if female students are taught mathematics and/or science by female teachers, the number of female students who major in STEM fields increases. School type difference was also investigated: Single-gender schools have positive effects on male students in majoring in STEM fields, but not on female students (Park et al., 2018).

In the context of educational settings in Japan, research on gender stereotypes dates back to the end of the 20th century. Muramatsu and Nakayama (1996) surveyed female students in Japan and found that female students who choose the science path thought their decision was affected by their teachers. Indeed, this study demonstrated that female students

needed role models and encouragement to pursue the science path. Kawano (2009) conducted a follow-up study and found similar results: It is hard for female students to choose the science path only based on their interests and curiosity. Ito (1997) mentions that the influence of family, school, and media affects students' idea of gender-based roles, which might lead them to the path they want to choose for the future. Ikkatai et al. (2019) investigated the effect of parental egalitarian attitudes towards gender roles on female students' path choices and found that parents with those attitudes are more likely to let their daughters choose whichever path they want to take. Takami and Ozawa (2022) found that if there were female role models in the science field or encouragement from teachers, female high school students were not influenced as much by gender stereotypes in their path choice.

Current Situation of High School Students and Gender Stereotypes

High school students in Japan are aware that gender stereotypes play a role in their choice. The organisation Plan International Japan surveyed two thousand Japanese high school students and found that 74.2% of the female students who participated in the survey answered that they feel that gender stereotypes could limit their potential (Plan International Japan, 2022). If female students refrain from choosing the science path because of gender stereotypes, it makes the gender distribution in the STEM fields unequal. That is not only a loss of the opportunity for the students themselves but also a potential loss for the STEM fields, since there is a possibility of losing potential promising workers. In addition, Inoue et al. (2021) mentioned that gender diversity is one of the significant factors in promoting problem-solving processes, which implies that having gender diversity in the workplace can enhance productivity.

This Study

Previous research shows that there is the influence of gender stereotypes on the path choice that female high school students in Japan make and that there are various elements that

cause or soften that influence, such as parents, teachers, and society. However, until now it has been unclear which of these elements are effective in reducing the influence of gender stereotypes on path choice. Therefore, this thesis aims to systematically characterise the proposed factors in the literature that influence female students' path choices. Furthermore, this paper aims to investigate which of these identified factors can be effective at reducing the influence of gender stereotypes on path choice.

The research question addressed in this contribution is then: Which factors are effective in reducing the influence of gender stereotypes on the path choice that female high school students in Japan make?

Method

Design

This study uses the method of systematic literature review. A systematic literature review is “a systematic way of collecting, critically evaluating, integrating, and presenting findings from across multiple research studies on a research question or topic of interest” (Pati & Lorusso, 2018). Using this method, articles regarding the influence of gender stereotypes on path choice are gathered and the factors that affect the influence are identified. Then what factors are potentially effective in reducing the influence of gender stereotypes on the path choice that female students make is investigated.

Inclusion Criteria

The relevant literature for this systematic review focuses on the influence of gender stereotypes on female high school students' path choices in Japan. Consequently, the following inclusion criteria were determined for the article selection: Studies must (1) be empirical; (2) focus on gender stereotypes in Japan; (3) mention the influence of gender stereotypes on female students' path choice in high school; (4) have been conducted between 1956 (when the current path choice system in Japan started) to 2022; and (5) be written either

in English or in Japanese. Since this study focuses on the occurrence in Japan, literature written in Japanese is also taken into the range of investigation so that more information can be gathered. If the same article is published both in English and in Japanese, they are de-duplicated and only one of them is left in the selection.

Search Strategy

Articles were sought through the databases: Scopus, ERIC, Web of Science and PsycINFO for articles written in English, and J Stage for Japanese articles.

Key words for the literature search in English were the following: (gender OR female* OR woman OR women OR girl*) AND stereotype AND (school* OR student*) AND Japan*. For Japanese literature, a set of (ジェンダー[gender] OR 女子[girl] OR 女性 [woman]) AND ステレオタイプ [stereotype] AND (学校 [school] OR 高校 [abbreviation for high school] OR 生徒 [student]) are used. Note that Japanese does not differentiate singular and plural nouns, thus only singular forms for the terms were employed for Japanese literature search. Considering the risk of excluding essential literature by narrowing the search scope, restrictive words such as “path choice” or “high school” were not used here but examined in the later stage of literature choice.

Study Selection

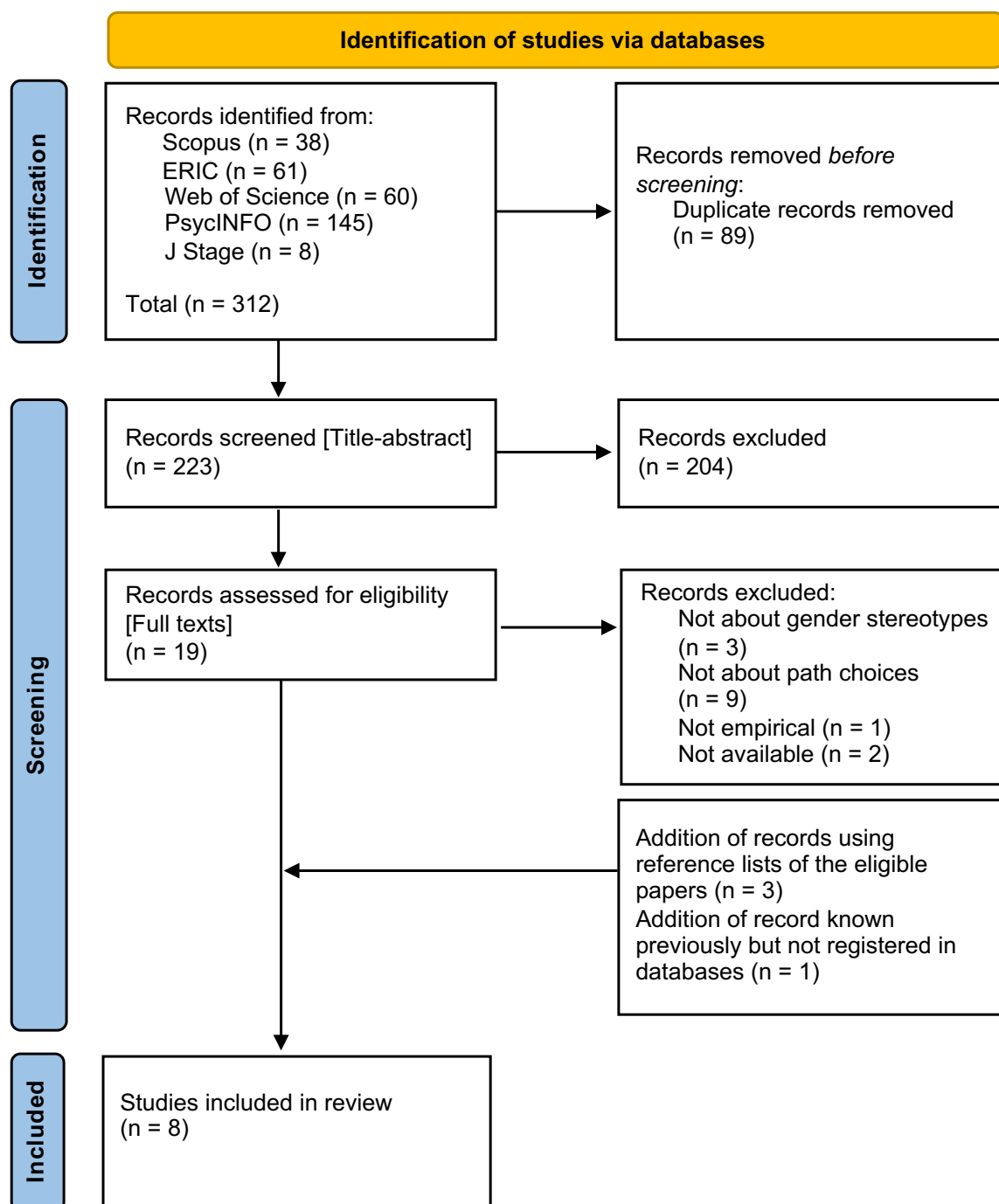
References obtained from all the databases were exported to Cadima. Cadima is an online tool supporting the conduct and reporting of systematic reviews (Kohl et al., 2018). First, the deduplication process is conducted by Cadima, followed by manual double-checking to ensure that no paper which should be included in the scope would be missing. After the deduplication, systematic synthesis was conducted according to the steps introduced in Petticrew & Roberts (2006). First, the titles and abstracts of the remaining papers were screened to examine if they fit each of the inclusion criteria. Afterwards, the full texts of the remaining papers were read and those who matched all the inclusion criteria were included in

the review. Finally, the literature in the reference list of the remaining papers was checked if they match the inclusion criteria or not, and if they did, they were also included in the review.

Figure 1 shows the process of the selection.

Figure 1

PRISMA Flowchart Showing the Study Selection



Note. This figure was designed according to the PRISMA guidelines by Page et al. (2021).

At first, 312 records were found in the databases. Through the deduplication process, 89 records were excluded. Then the titles and abstracts of the remaining 223 studies were checked, and 204 of them were excluded. With the remaining 19 studies, the full-text check was conducted, which resulted in four studies left in the search scope. Then the reference lists of the studies were examined, and three relevant studies found were also included in the search scope. One study which was relevant to the topic and was previously known but not registered in the databases was also included. As a result, after the entire selection process, eight studies were left in the search scope. Table 1 shows the information about the literature included in the review.

Table 1*Information of the Literature in the Search Scope*

	Studies	Participants	Grade/Age /Year	Sample size	Method	Main findings
1	Nakanishi (1993)	High school students in girls' schools	9th grade	513 (Female only)	Quantitative	<ul style="list-style-type: none"> - Schools' attitudes towards gender-based roles have an influence on female students' field choice in their future study - Schools can lessen the effects of ideas of gender-based role that students obtained in their family
2	Kawano (2009)	University students in an interdisciplinary department	1st-3rd year	2348 (F: 557, M: 1771)	Quantitative	<ul style="list-style-type: none"> - Female students tend to be indecisive in choosing their path - Female students are more likely to take the advice from others into consideration when making path choices - Both teachers and students consider the science path superior to the humanities - More female students had experienced listening to people around them associating gender and path than their male counterparts
3	Isa & Chinen (2014)	Elementary school students, junior high school students	3rd-9th grade	Not mentioned (data from the schools in the whole city)	Quantitative	<ul style="list-style-type: none"> - Even though there is no gender gap in maths scores in elementary school, more girls feel they are not good at it, which eventually influence their attitude and ability in that subject - In order for girls to choose science path, they not only have abilities and motivation in scientific subjects but also learn to have meritocratic values
4	Ikkatai et al. (2019)	Parents	40-69 years old	1236 (F: 618, M: 618)	Quantitative	<ul style="list-style-type: none"> - Egalitarian parents agreed more with girls' freedom to choose any academic field (not just STEM fields) - Mothers, young parents, university graduates showed more agreement on girls' choice in STEM fields than fathers, old parents, and non-university graduates - It's easier for parents to agree with girls' choice in STEM fields if they can have a clear image of the future jobs

	Studies	Participants	Grade/Age /Year	Sample size	Method	Main findings
5	Hanawa (2020)	High school students	Not mentioned	4038 (F/M: Not mentioned)	Quantitative	<ul style="list-style-type: none"> - More female students believe that males are more scientifically oriented - Both female students in girls' schools and male students in boys' schools have more gender-based role ideas than their counterparts in co-ed schools
6	Inoue et al. (2021)	High school students	8th grade	713 (F:373, M:340)	Quantitative	<ul style="list-style-type: none"> - Female students who have gender-based role ideas have less tendency to choose the science path - No correlation was found between subject-specific gender stereotype and tendency to choose the science path - Female students from relatively rich family tend to choose the science path - Male students with a university-graduate father tend to choose the science path
7	Takami & Ozawa (2022)	University students	1st-4th year	7 (Female only)	Qualitative	<ul style="list-style-type: none"> - Teachers show stereotypical address that the science path is more preferable - If students have a good relationship with teachers or there is a female role model round them who engage in science field, they are less likely to be influenced by gender stereotypes - When students get stuck in scientific subjects and cannot get support, subject-specific gender stereotypes can work on them - The degree of influence of gender stereotypes that female students get from their mothers or teachers depends on each student's values and beliefs
8	Takamatsu (2022)	High school students	8th grade	1070 (F/M: not mentioned)	Quantitative	<ul style="list-style-type: none"> - Female students typically aim for the field where specific occupations are associated (medical field, educational field) - The fields female students typically aim for require relatively shorter years of higher education

As for the analytical procedure for the findings of the literature, ideas suggested by Nakanishi (2021) were implemented as inspiration from the main themes presented in the results. Nakanishi claimed that factors that can cause a gender gap in educational “results” (not opportunities) are hidden curriculum at school such as male-female teacher distribution balance, teacher-student interaction, peer pressure, and school culture, expectation from parents, and how effective higher education is considered in the neoliberal society. Based on this idea, the following categories for the analysis are formulated: (1) students themselves, (2) teachers, (3) parents, and (4) surroundings including school systems, society, and peers. Firstly, the findings from the literature are summarised according to those categories, and then suggestions mentioned in the studies in the review are investigated.

Results

Findings

Students

There are findings about different characteristics between male and female students which affect their path choice and their view towards scientific subjects. Kawano (2009) pointed out the gender difference in the way students choose a path, showing that female students are more likely to take others’ opinions into account in their path choice than male students. This suggests that there are more chances for female students to be influenced by gender stereotypes that other people have. Isa and Chinen (2014) reported that female students tend to have a negative attitude towards scientific subjects compared to male students even though they acquire the same level of mastery. This could affect their motivation and performance in those subjects. In the same study it is also mentioned that for female students to choose the science path, they need to adopt the value of meritocracy, which is thought to be more familiar to male students.

Takamatsu (2022) mentioned that female students who choose the science path tend to aim for medical field where students can easily associate occupation. This implies that female students might not have a clear image of what jobs are available for female workers in other science fields.

There is a contradiction in the findings about students' gender stereotypes. Hanawa (2020) showed that compared to male students, more female students agreed with the idea that science is for men. On the contrary, Inoue et al. (2021) reported that there was no significant difference between female and male students' subject-specific gender stereotypes. Inoue et al. also showed that female students who agreed with gender-based roles are less likely to choose the science path than those who disagreed or did not agree or disagree.

It is also pointed out that female students' values and beliefs play a role in deciding the impact of gender stereotypes held by people around them. Takami and Ozawa (2022) reported that some female students in their study mentioned that they did not inherit their mothers' stereotypical gender-based role ideas. On the contrary, they explained that those ideas helped them develop an attitude towards being independent as a woman. Takami and Ozawa also reported that if female students have firm values and beliefs that help them choose the science path, they are not subject to their teachers' gender stereotypes towards paths.

In summary, female students have less chance of choosing the scientific path due to their negative attitudes towards scientific subjects, their gender-based role ideas, and the necessity to adopt meritocracy. The tendency of female students to listen to advice from others in choosing a path can also affect their choice. However, the extent to which a student is influenced by gender stereotypes from the people around them depends on the student's own values and beliefs.

Teachers

Several studies have mentioned how teachers impact female students' path choices. Kawano (2009) reported that female students are more likely to experience subject-specific gender stereotypical remarks from teachers than their male counterparts do. This means that female students are more exposed to gender stereotypes that could direct them away from choosing the science path.

Takami and Ozawa (2022) also reported many findings about teachers' impact. It was found that teachers tend to recommend students who are good at scientific subjects to proceed to the science path regardless of the student's intentions. The authors also mentioned teachers' bias toward the science path as superior to the humanities. In the same study, the effects of role models to whom female students can trust or feel related are also reported. If female students can be taught by or reach out to female mathematics or science teachers, subject-specific gender stereotypes are less likely to affect them. This is especially effective when female students are about to lose their confidence in those subjects and change their intention to choose the science path.

Takami and Ozawa (2022) also warned that there is a negative effect caused by the trust that female students have in teachers. If students listen to teachers' advice which is based on gender stereotypes, it can negatively impact the students' path choices. This is more dangerous for female students since they are more likely to take teachers' advice into consideration when they choose a path (Kawano, 2009). Still, as explained in Takami and Ozawa, not all female students are affected by teachers' gender stereotypes in the same way; if students have strong non-gender stereotypical values and beliefs, they are less likely to be influenced by others' gender stereotypes.

To summarise, teachers can both positively and negatively influence female students' path choices. Female teachers can serve as role models, which can positively affect female students' path choices, but sometimes teachers' subject-specific gender stereotypes can

discourage female students to choose the science path. However, how much influence students take from teachers' gender stereotypes on their path choices differs from person to person.

Parents

Among the eight studies in the search scope, only Ikkatai et al. (2019) used the data collected from a survey among parents. They asked the participants if they agree with girls' (in general) freedom to major in a specific field at university and the reason why they agree or disagree. It turned out that parents with egalitarian attitudes agreed with girls' freedom to major in any field of their choice. This applied not only to STEM fields but also to other fields including social sciences. The authors also showed that mothers with egalitarian attitudes were more supportive than fathers with those attitudes in girls' choice in STEM fields. The same applied to young parents compared to older ones, and university graduates compared to non-university graduates. This implies that the younger generations and those who were once at university might have had more opportunities to witness female students in the STEM fields, and thus are less inclined to subject-specific gender stereotypes.

Ikkatai et al. (2019) also reported that within the fields that students can reach through the science path, more parents agreed with girls' choice in the fields where they can easily associate occupations (e.g., pharmacists, doctors, and nurses). This finding aligns with the tendency for female students in the science path to choose those fields, as stated by Takamatsu (2022). It seems easier for parents to agree with their daughters proceeding in the science path if they can picture the image of their daughters having a job after graduation.

There are potential limitations in this study. Ikkatai et al. (2019) reported that 35% of those who agreed with girls' freedom to choose a specific field on average mentioned "other" as a reason why they agreed. Most of them described that they think women are free to choose any fields they want to go to, which was not displayed as the options they can choose from as

a reason. There is a possibility that the participants who have this opinion might also have chosen “neither agree nor disagree.” If there was an option for “women should be able to choose any field according to their will,” the distribution of the results might have changed. In addition, this study did not investigate the participants’ view towards how much parental intervention should be done in students’ path choices. The participants’ views towards students’ autonomy in path choice could also have affected their degree of agreement.

Inoue et al. (2021) also mentioned parents’ influence on path choices. It is reported that female students from families with substantial income are more likely to choose the science path. Regarding male students, those with a father who graduated from university are more likely to choose the science path. This implies that the influence from parents affects male and female students differently. However, other factors possibly exist behind that. For example, it has been reported that both family income and parents’ education level positively correlate with students’ academic outcomes (Ochanomizu University, 2017). Therefore, the correlation of family conditions and students’ path choices needs more investigation.

In conclusion, parents with egalitarian views are more likely to support female students’ path choices in STEM fields, especially in the fields where parents can easily think of associated occupations. Mothers seem to be more supportive of girls’ path choices in STEM fields, and parents’ age and educational backgrounds are also related to their views towards girls’ pursuits in those fields. Association with other factors such as how much intervention parents think they should make in their children’s path choice should be investigated to derive more insights on the parents’ impact.

Surroundings

Characteristics of schools can also impact female students’ path choices. Nakanishi (1993) surveyed female students in three different girls’ schools. The results showed that if school policies are more inclined to gender-based roles such as “to foster a good wife and a

wise mother,” students are less likely to choose the science path. In the same study, it is also reported that school policies have an impact that makes students reform their ideas towards gender-based roles that their family shares. This shows a possibility that even though students have been exposed to gender stereotypes at home, schools can help students get rid of that mindset and choose the science path if they want to.

The way schools are composed can also influence students. Hanawa (2020) reported that students (both male and female) in single-gender schools showed a tendency to agree with gender-based role ideas compared to their counterparts in co-educational schools. This suggests that students in single-gender schools have been more exposed to gender stereotypes, which they eventually took in. However, a prior study on single-gender education in England reported that single-gender schools have a counter impact on gender stereotypical subject choice (Spielhofer et al., 2004). Hanawa (2020) and Inoue et al. (2021) both mentioned the possibility that subject-specific gender stereotypes and gender-role stereotypes work differently, but other factors such as cultural differences can affect the roles single-gender schools play on students.

Gender stereotypes in society cannot be ignored since they can impact gender stereotypes that individuals have and thus affect the path choice that female students make. Among the papers in this review, Kawano (2009) and Inoue et al. (2021) reported that school systems, teachers, and students have the idea that the science path is “superior” to the humanities path. Takami and Ozawa (2022) also reported one student saying that they chose the science path because it is socially considered a “better” path. It is suggested that the fact that occupations in STEM fields are paid better than those in other fields might cause this “science as superior” idea (Beede et al., 2011). There is a possibility that the importance students place on their future job status and income can also affect their path choice.

There were no specific findings reported about how peers affect female students' path choices. However, Takami and Ozawa (2022) reported that one participant in their study mentioned the influence of peers. That participant mentioned that when she was wondering which path she would take, the fact that many female friends of hers had chosen the humanities path influenced her to choose the same path. Since female students are more likely to listen to other people's advice when it comes to path choices (Kawano, 2009), it is plausible that their path choice can also be influenced by their peers.

Suggestions for Reducing the Influence of Stereotypes

In this section, ideas suggested in the studies for reducing the gender gap in path choice are reviewed. First, providing information and opportunities to know about STEM fields to students and/or parents was suggested in several studies (Ikkatai et al., 2019; Kawano, 2009). Ikkatai et al. (2019) stressed the importance of helping fathers to improve their attitudes towards girls' freedom to choose STEM fields. Takamatsu (2022) also mentioned the importance of enhancing understanding and support from family so that female students can more freely choose to proceed to higher education. In terms of different kinds of gender stereotypes, Hanawa (2020) claimed that students who are less influenced by subject-specific gender stereotypes can still have gender-based role ideas, and thus those two stereotypes are two separate ideas. A similar idea was suggested by Inoue et al. (2021). The authors pointed out that in order to reduce gender stereotypes, both subject-specific gender stereotypes and gender-based role ideas in society need to be tackled.

Secondly, actions that teachers can take were also proposed. Takami and Ozawa (2022) mentioned that teachers need to be more aware of how gender stereotypes that they have can affect female students' path choices. The authors also suggested that teachers should try to build a good relationship with students, pay attention to their family conditions, and cooperate with other teachers as a team. However, the last two points were not explained in

detail about how they positively influence female students' path choices. The authors might have tried to stress the importance for teachers to have a broader view in order to prevent gender stereotypes from interfering with female students' path choices.

Some other suggestions were made on a larger scale. Takami and Ozawa (2022) mentioned that more investigations are needed on how cultural and social factors can affect female students' path choices. Takamatsu (2022) also stated that the educational and occupational environment should be changed in order to encourage female students to proceed into STEM fields. Kawano (2009) claimed that in the long run, we can consider the reform of the current path choice system since not all disciplines and occupations can be divided by science or humanities.

Discussions

Conclusion

This study aimed at finding factors that are effective in reducing the influence of gender stereotypes on the path choice that female high school students in Japan make. The review of the literature provided that there is a gender gap in how students make their path choice and how many gender-stereotyped remarks they experience. In addition, there is an association between choosing the humanities path and gender-based role ideas that female students have. The review also suggested that parents, teachers, school systems, and society hold some kind of gender stereotypes, which can also affect female students' path choices. However, how much influence female students get from those gender stereotypes differs depending on the values and beliefs that each student has. The existence of female role models in scientific fields can reduce the influence of gender stereotypes on female students' path choice.

From this, three factors which can contribute to reducing the influence of gender stereotypes on female students' path choice are suggested; (1) enhancing female students'

non-stereotypical values and beliefs, (2) increasing the opportunities for female students to know and/or meet role models, and (3) providing information about the current situation of female workers in STEM fields to students, parents, and teachers.

First, female students' non-stereotypical values and beliefs should be enhanced. The review showed that this can be powerful in reducing the influence of gender stereotypes that they are exposed to, as stated by Takami and Ozawa (2022). If female students believe that all people are equally free to choose whatever field they want to pursue, they are less likely to choose the humanities path just because that has been traditionally considered as the one for women. Enhancing students' autonomy and responsibility in their path choices is also key. If students feel that it is their responsibility to make decisions by themselves, they are less likely to take others' advice into account without enough consideration. This can contribute to reducing the impact of gender stereotypes held by people around them on the path choice they make. It is reported that 71% of high school students answered that they want advice from parents in deciding which path they should choose (National High School PTA Federation & Recruit, 2022). This means that many students are not confident in making decisions on their own. It may take a long time to foster students' confidence, so measures to help them should be taken even before students start to think about their path choices. The latest educational reform in Japan puts stress on fostering students' ability to think about difficult and complex tasks from elementary school (MEXT, 2017). This change in education might help future high school students to be more confident in their decision on which path they want to choose.

Secondly, opportunities to get to know female role models in STEM fields should be enhanced. The review showed that female students who have role models in scientific fields are less likely to be influenced by gender stereotypes in their path choice, as stated by Takami and Ozawa (2022). A survey showed that female students whose mothers majored in STEM fields at university showed a higher tendency in choosing STEM fields as their major

(Libertas Consulting, 2018). This also suggests that having a clear image of what roles females can play in STEM fields helps female students choose the science path. As practical measures, the Japanese government has been promoting events for female students where they can meet women who work in STEM fields, listen to their stories, and ask questions (Gender Equality Bureau Cabinet Office, n.d.). Some universities in Japan also hold similar events (Japan Science and Technology Agency, n.d.). Schools and teachers can encourage female students to participate in those events so that they can get clearer images of working in STEM fields. In addition, schools can make opportunities for their students to listen to the talk of women in STEM fields by inviting them as guest speakers. Holding these events can also create a school atmosphere that encourages female students to pursue STEM fields. Nakanishi (1993) mentioned that school policy can reform students' beliefs regarding gender stereotypes that were created at home. This suggests that if the atmosphere of the school does not support gender stereotypes, that can make a positive impact on students' beliefs.

As a third point, providing information about the current situation of female workers in STEM fields is also an important factor. Even though students are confident in deciding their path on their own, if their ideas are based on the wrong image of the paths or fields, their choice can still be influenced by gender stereotypes. Therefore, students need to obtain correct information about the paths and the fields that they can pursue. Regarding the parents and teachers, they might stick to the image of STEM fields that they created when they were young, though the situation in those fields has been changing. By gaining current information about STEM fields, they can reform their ideas towards those fields. If they understand that women can play an active role in STEM fields, their gender stereotypes towards specific subjects can be reduced. In this regard, the media can also play a role in spreading information about current STEM fields, which will help reform the social view towards the relationship between women and STEM fields.

Teachers are also key in this point. The Japan Institute for Labour Policy and Training (JILPT) reported that in most high schools in Japan, students have one-on-one consultations with their teacher several times a year, where their future career is discussed (JILPT, 2017). There are also opportunities for parents to join those consultation meetings once or twice a year (JILPT, 2017). These meetings can help teachers detect that either students or parents have gender stereotypes towards STEM fields based on wrong or outdated information. In those cases, teachers can provide them with up-to-date information that can reform or reduce gender stereotypes. By doing that, teachers can eventually lessen the influence of gender stereotypes on the path choice that students make. At the same time, teachers also need to be provided with opportunities to update their knowledge about current academic fields and labour markets. Since teachers' gender stereotypes have been witnessed by students (Takami & Ozawa, 2022), it is important that teachers themselves try to reflect on their views by catching up with the latest conditions of society.

Consideration for Future Research and Limitations

Finally, suggestions for future studies on the influence of gender stereotypes on path choices in Japan are made. First, the mechanism of how female students form path choices needs to be investigated more in detail. The review showed that various factors interact with each other, and those interactions determine how students' path choices are affected. This suggests that the process of path choice is quite complex and thus it is difficult to conclude what measure is effective in reducing the influence of gender stereotypes. There was no intervention study found in this search scope, and only one qualitative study was included. With more intervention studies and qualitative studies conducted, we can obtain a more causal and in-depth understanding of the mechanism. That will help find effective measures to reduce the influence of gender stereotypes. The effect of the current campaigns conducted and

promoted by the government and universities in increasing the number of female students in STEM fields can also be investigated.

Secondly, studies should be more easily accessible to researchers all over the world. Of the eight studies included in this review, only one was written in English. Four other studies contain an abstract written in English, but those studies were not accessible in English-based search engines such as Scopus and ERIC. If the findings of studies conducted in Japan are also reported in English, researchers all over the world can access them more easily, which will contribute to making more progress in this research field.

The limitation of this study was that it only focused on the studies conducted in Japan and did not investigate studies in other countries. Literature on the same research topic in other contexts might suggest ideas that can also be applied to Japan. Nevertheless, this study is worth summarising the findings written in Japanese and sharing them in English, which makes them accessible to more researchers in the world.

Factors that make gender stereotypes influence female students' path choices are intertwined, which makes it complicated to understand how they affect each other. However, it also means that if one of those factors can be changed for the better, it can impact the whole process of the influence of gender stereotypes on female students' path choices. It may take time, but it does not mean that the current situation is unchangeable.

References

References marked with an asterisk indicate studies included in the final selection of the systematic review.

Beede, D. N., Julian, T. A., Langdon, D., McKittrick, G., Khan, B., & Doms, M. E. (2011).

Women in STEM: A Gender Gap to Innovation. U.S. Department of Commerce

Economics and Statistics Administration. <http://dx.doi.org/10.2139/ssrn.1964782>

Beilock, S. L., Gunderson, E. A., Ramirez, G. & Levine, S. C. (2010). Female teachers' math anxiety affects girls' math achievement. *Psychological and Cognitive Sciences*, *107*(5), 1860-1863. <https://doi.org/10.1073/pnas.0910967107>

Bleeker, M. M., & Jacobs, J. E. (2004). Achievement in math and science: do mothers' beliefs matter 12 years later? *Journal of Educational Psychology*, *96*(1), 97–109.

<https://doi.org/10.1037/0022-0663.96.1.97>

Carrell, S. E., Page, M. E., & West, J. E. (2010). Sex and science: How professor gender perpetuates the gender gap. *The Quarterly Journal of Economics*, *125*(3), 1101–1144.

<https://doi.org/10.1162/qjec.2010.125.3.1101>

Cobuild, C. (2012). Stereotype. In *Collins COBUILD advanced dictionary of English* (7th ed.). Heinle & Heinle Pub.

Eccles, J. S. (2007). Where are all the women? Gender differences in participation in physical science and engineering. In S. J. Ceci & W. M. Williams (Eds.), *Why aren't more women in science?: Top researchers debate the evidence* (pp. 199–210). American Psychological Association. <https://doi.org/10.1037/11546-016>

Gender Equality Bureau Cabinet Office. (n.d.). *What's Riko-challe?* Rikō charenji [Challenge in science and technology]. Retrieved May 30, 2023, from

https://www.gender.go.jp/c-challenge/about_rikochalle/index.html

- *Hanawa, E. (2020). Jendāsa ni chakumoku shita kōkōsei no kōdōkeizaigaku teki tokusei ni kansuru ichi kōsatsu. [A behavioral economic analysis of high school students, focusing on gender difference]. *The Journal of Economic Education*, 39(39), 155-170. https://doi.org/10.24476/eoedu.39.39_155
- *Ikkatai, Y., Inoue, A., Kano, K., Minamizaki, A., McKay, E., & Yokoyama, H. M. (2019). Parental egalitarian attitudes towards gender roles affect agreement on girls taking STEM fields at university in Japan. *International Journal of Science Education*, 41(16), 2254–2270. <https://doi.org/10.1080/09500693.2019.1671635>
- *Inoue, A., Ikkatai, Y., Minamizaki, A., Kano, K., McKay, E., & Yokohama, H. M. (2021). Kōkōsei no jendā stereotaipu to rikei e no shinro kibō [Gender stereotypes and students' intentions to choose majors]. *Journal of Science and Technology Studies*, 19, 64–78. https://doi.org/10.24646/jnlsts.19.0_64
- *Isa, N. & Chinen, W. (2014). Rikei kamoku ni okeru gakuryoku to iyoku no Jendā sa [Gender gap in competency and motivation in scientific subjects]. *The Japanese journal of labour studies*, 56(7), 84–93.
- Ito, Y. (1997). Kōkōsei ni okeru seisakan no keisei kankyō to sei yakuwari sentaku [The formative factors of gender conception and its relationship with a selection of gender roles in adolescents]. *Japanese Journal of Educational Psychology*, 45(4), 396–404. https://doi.org/10.5926/jjep1953.45.4_396
- Jacobs, J. E., & Eccles, J. S. (1992). The impact of mothers' gender-role stereotypic beliefs on mothers' and children's ability perceptions. *Journal of Personality and Social Psychology*, 63(6), 932–944. <https://doi.org/10.1037/0022-3514.63.6.932>
- The Japan Institute for Labour Policy and Training (JILPT). (2017). *Kōtōgakkō no shinro shidō to kyariagaidansu no hōhō ni kansuru chōsa kekka* [A survey on the ways of

career guidance in high school].

<https://www.jil.go.jp/institute/research/2017/documents/167.pdf>

Japan Science and Technology Agency. (n.d.). *Joshi chūkōsei no rikei shinro sentaku shien puroguramu* [Programmes to support female junior and senior high school students' path choice in science]. Retrieved May 30, 2023, from

<https://www.jst.go.jp/cpse/jyoshi/index.html>

*Kawano, G. (2009). Joshi kōkōsei no “bun” “ri” sentaku no zittai to kadai [Course choices of female students of Japanese high school]. *Journal of Science and Technology Studies*, 7, 21–33. https://doi.org/10.24646/jnlsts.7.0_21

Kohl, C., McIntosh, E. J., Unger, S., Haddaway, N. R., Kecke, S., Schiemann, J., & Wilhelm, R. (2018). Online tools supporting the conduct and reporting of systematic reviews and systematic maps: a case study on CADIMA and review of existing tools. *Environ Evid*, 7(8). <https://doi.org/10.1186/s13750-018-0115-5>

Libertas Consulting. (2018). *Joshi seito tō no rikōkei shinro sentaku shien ni muketa seito tō no ishiki ni kansuru chōsa kenkyū* [A research of attitudes in high school students for supporting girls' choice of science and engineering path].

https://www.gender.go.jp/research/kenkyu/pdf/girls-course_h29.pdf

Ministry of Education, Culture, Sports, Science and Technology (MEXT). (n.d.). *Overview*.

<https://www.mext.go.jp/en/policy/education/overview/index.htm>

Ministry of Education, Culture, Sports, Science and Technology (MEXT). (2017). *Gakushū shidō yōryō* [Course of study]. https://www.mext.go.jp/a_menu/shotou/new-cs/1383986.htm#section4

Ministry of Education, Culture, Sports, Science and Technology (MEXT). (2021). *Kotōgakkō kyōiku no genjō ni tsuite* [Current situation of high school education].

https://www.mext.go.jp/a_menu/shotou/kaikaku/20210315-mxt_kouhou02-1.pdf

- Morinaga, Y. (2017). “Josei wa sūgaku ga nigate” – sutereotaipu no eikyō ni tsuite kangaeru [“Women can’t do math”: A review of the social psychological literature on the effects of negative stereotypes on both women and girls]. *Japanese Psychological Review*, 60(1), 49–61. https://doi.org/10.24602/sjpr.60.1_49
- Morinaga, Y., Sakata, K., Furukawa, Y., & Fukudome, K. (2017). Joshi chūgakusei no sūgaku ni taisuru iyoku to sutereotaipu [Mathematics motivation and gender stereotypes of junior and senior high school girls]. *Japanese Journal of Educational Psychology*, 65, 375-387. <https://doi.org/10.5926/jjep.65.375>
- Muramatsu, Y., & Nakayama, Y. (Eds.). (1996). *Josei no rikei nōryoku o ikasu – Senkō bun’ya no jendā bunseki to teigen* [To make use of the science ability of women – Analysis on majors based on genders and suggestion] (1st ed.). Nihon Hyōronsha.
- *Nakanishi, Y. (1993). Jendā torakku – Sei yakuwarikan ni motozuku shinro bunka mekanizumu ni kansuru kōsatsu [Gender track – Reflection about the mechanism of career division based on gender-based roles]. *The Journal of educational sociology*, 53, 131–154. <https://doi.org/10.11151/eds1951.53.131>
- Nakanishi, Y. (2021). Gakkō kyōiku ni okeru danjo kyōdō sankaku no genjō to kadai: kyōiku sentaku no jendā kōsei o mezashite [Current situation of gender equality at school: Aiming for gender equality in educational choice]. *NWEC Jissen Kenkyu*, 11, 6–31. <https://www.nwec.go.jp/about/publish/jpk9qj0000002fvq.html>
- National High School PTA Federation & Recruit. (2022). *Kōkōsei to hogosha no shinro ni kansuru ishiki chosa* [Survey of high school students' and parents' perceptions of their career paths]. https://souken.shingakunet.com/research/.assets/2021_hogosya3.pdf
- National Institute for Educational Policy Research (NIER). (2012a). *Rikei bunkei shinro sentaku ni kakawaru ishiki chōsa* [Survey on the attitudes towards the choices in science and humanities]. <https://www.nier.go.jp/kaihatsu/pdf/zokuseichi-report.pdf>

- National Institute for Educational Policy Research (NIER). (2012b). *Upper Secondary Education in Japan*. <https://www.nier.go.jp/English/educationjapan/pdf/201209SE.pdf>
- Ochanomizu University. (2017). *Hogosha ni taisuru chōsa no kekka to gakuryoku to no kankei no senmontekina bunseki ni kansuru chōsa kenkyū* [An analysis on the relation between parents and students' academic outcomes].
https://www.nier.go.jp/17chousa/pdf/17hogosha_factorial_experiment.pdf
- The Office of the High Commissioner for Human Rights (OHCHR). (n.d.). *Gender stereotype*. <https://www.ohchr.org/en/women/gender-stereotyping>
- The Organization for Economic Cooperation and Development (OECD). (2017). *The pursuit of gender equality: an uphill battle*. OECD Publishing.
<https://doi.org/10.1787/9789264281318-en>.
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Aki, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S.,...Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *PLOS Medicine*, *18*(3), Article e1003583.
<https://doi.org/10.1371/journal.pmed.1003583>
- Park, H., Behrman, J. R., & Choi, J. (2018). Do single-sex schools enhance students' STEM (science, technology, engineering, and mathematics) outcomes? *Economics of Education Review*, *62*, 35-47. <https://doi.org/10.1016/j.econedurev.2017.10.007>
- Pati, D., & Lorusso, L. N. (2018). How to write a systematic review of the literature. *HERD: Health Environments Research & Design Journal*, *11*(1), 15-30.
<https://doi.org/10.1177/1937586717747384>
- Petticrew, M., & Roberts, H. (2006). *Systematic reviews in the social sciences: A practical guide*. Blackwell Publishing. <https://doi.org/10.1002/9780470754887>

Plan International Japan. (2022). *Nihon no kōkōsei no jendā sutereotaipu ishiki chōsa* [Survey on Japanese high school students' attitude towards gender stereotypes].

<https://www.plan->

[international.jp/news/info/pdf/0415_Gender_stereotype_report_Final.pdf](https://www.plan-international.jp/news/info/pdf/0415_Gender_stereotype_report_Final.pdf)

Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). Stereotype threat and women's math performance. *Journal of Experimental Social Psychology, 35*, 4–28.

<https://doi.org/10.1006/jesp.1998.1373>

Spielhofer, T., Benton, T., & Schagen, S. (2007). A study of the effects of school size and single-sex education in English schools. *Research Papers in Education, 19*(2), 133–

159. <https://doi.org/10.1080/02671520410001695407>

*Takami, K., & Ozawa, S. (2022). Joshi gakusei no bunri sentaku no ketsudan ni sutereotaipu ga oyoboshita eikyou ni kansuru shitsuteki kenkyū [Qualitative research on the influence of stereotypes on female students' decision to choose humanities or science majors]. *Japan Journal of Educational Technology, 46*(2), 255-273.

<https://doi.org/10.15077/jjet.45086>

*Takamatsu, R. (2022). Shinro sentaku ni okeru jendā torakku: danjo kan dōsei nai no shinro kibō no chigai ni chūmoku shite [Gender track in the choice of major in higher education: differentiation between males and females and among the same gender].

Sociological Theory and Methods, 37(2), 170–183.

<https://doi.org/10.11218/ojjams.37.170>