

Perceived Agency of In-Service Physics Teachers in Japan and Austria

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Abstract

Dissemination of reformed curriculum requires teachers to feel that they have the freedom to implement the curriculum in the classroom. Even instructors who are trained in research-based instruction and are convinced of its value might fail to implement the curriculum in the classroom if, for example, they feel like doing so would jeopardize their ability to cover the contents required by the national standards. We created the "Perceived Agency Survey" to assess teacher views about such issues and administered it to physics teachers in Austria (where teachers are given considerable freedom in their teaching by the national standards) and Japan (which has national standards that are regarded as more demanding of teachers). In this paper, we will show which items of the survey indicate differences in views between the two groups of teachers, and we will discuss recent interviews with teachers about how Corona has affected their perceived agency.

1. Introduction

Despite instructing our pre-service teachers (PSTs) in the use of research-based curriculum and teaching approaches, we do so with the humble recognition that our graduates might choose not to use these materials in their future schools. This can occur if our PSTs do not "buy in" to the new methods and materials (e.g., Goertzen, 2010). However, equally decisive a factor for whether physics education research finds its way into the classroom is the "perceived agency" of a teacher. We do not mean "agency" in the sense of a secret agent, a nameless extension of an organization. Rather, our usage of the word aligns more closely with the definition of Lipponen and Kumpulainen (Lipponen & Kumpulainen, 2011): "the capacity to initiate purposeful action that implies will, autonomy, freedom, and choice." In particular, we define "perceived agency" of teachers and PSTs to be "a feeling of being in control over what is taught and of how it is taught" (Hull & Uematsu, 2020a). Education researchers have documented a number of reasons that teachers may have a low perceived agency, including student and parent preferences or expectations for traditional instruction, institutional inertia, and demands imposed by national standards and standardized testing (Ball & Cohen, 1996; Biesta, Priestley, & Robinson, 2015; Wei & Chen, 2019). From our personal experience, we have found that these latter two factors can be particularly influential on teachers and PSTs in Japan. Graduates of the second author from Tokyo Gakugei University have occasionally reported that they face pressure from the schools at which they begin their teaching careers to not use research-based curriculum as it is too different from what other teachers at the school have been using (it goes against the status quo). The second author has

frequently experienced teachers in Japan expressing the concern that interactive engagement teaching methodologies and curriculum will demand more time to implement than what is allowed by the national curriculum. Although such concerns are shared by teachers and PSTs across the globe, the experience of the first author has been that teachers and PSTs in Austria tend to see the national standards ("Lehrplan") as being considerably open-ended.

To go beyond our anecdotal experience with teachers and PSTs, we created, validated, and administered the Perceived Agency Survey. In our earlier work, we have discussed the validation process of the survey and a comparison of PST responses at our institutions using Rasch analysis (Hull & Uematsu, 2020a, 2020b; Hull, Vormayr, & Uematsu, 2019). In this paper, we will discuss responses from in-service teachers. Although in this paper we draw upon descriptive statistics, we hope to accumulate additional data for the use of Rasch analysis in the future.

2. Methodology

The Perceived Agency Survey consists of 44 Likert-scale items. Each item contains a statement with which respondents can either "Strongly Agree" (5), "Strongly Disagree" (1), or something in between. As is common with Likert-scale surveys in physics education research (Adams et al., 2006; Redish, Saul, & Steinberg, 1998; Wilcox & Lewandowski, 2017), we collapsed the data to have three levels representing "agree" if the respondent selected "5" or "4", "disagree" if the respondent selected "1" or "2", and "neutral" if the respondent selected "3". Thirteen of these items did not pass the expert panel we conducted at the University of Vienna (Hull & Uematsu, 2020a),

1	I will consider carefully what physics textbook to use in my classroom.
2	If the principal of my school tells me to teach in a certain way, I will do my best to teach that way, even if I don't really want to.
3	If my physics students do not understand what they are learning, I will take more time with the material, even if that means that some planned topics are not taught in class.
4	I prefer curriculum that tell the teacher exactly what to do, so that I don't risk making the wrong decision.
6	I will just use whatever physics textbook the teacher before me used. If it was good enough for him/her, then it is good enough for me.
9	It might be the case that at my school where I am teaching, a more experienced teacher will not want me to use research-based pedagogy but to instead stick to traditional ways of teaching. Nevertheless, I will keep trying to introduce curriculum that I think will be the most effective.
13	Once I choose a physics textbook, I will just use it, at most, as a guide. I will not hesitate to skip sections or point out to students which parts I think are poorly-worded, confusing, or wrong.
14	Teaching is just a job so I can get a paycheck – there is no benefit to me beyond that.
15	Outdated equipment at my school is not an excuse for a poor lesson. I will just have to rely more on creativity!
16	It doesn't really matter whether I do my part in helping students learn or not—they will meet plenty of other teachers.
17	I feel that I have control over what I teach and how I teach it.
18	What my students learn in my class will have little benefit for them in other courses and/or in everyday life.
19	I will provide quality education to my students, even if I need to spend more time preparing for class than my colleagues do.
20	Once I choose a physics textbook for my classroom, I will follow it carefully.
21	I think I have influence over the progress of my students.
23	I will teach in the way I think is best, regardless of what my principal or other teachers might think.
27	Curricular resources are, at most, a guide for teachers to use or modify creatively, as the situation requires.
28	My students will have taken many classes before taking my class, and they will have an idea of how a class "should go". I need to teach in that style too, otherwise it will be too strange for my students.
29	Parents should not tell me what or how to teach – I am the expert, not them.
30	I will use the curriculum the teacher before me used at the schools where I will teach, even if it is ineffective, because I don't want to cause any trouble.
32	Generally, someone else decides what and how I teach.
33	In my physics class, I will combine textbooks and other materials, taking the best from each source.
35	The skills my students learn in my class, if any, will have little benefit to them once they graduate from school.
36	I find personal value in teaching.
37	The content I teach and the way that I teach it are not something for me to decide.
38	I feel responsible for doing my part in helping my students learn.
39	I will not work more than my colleagues in preparing lessons, even if the quality of my lessons suffers.
40	I think what my students learn in my class will be useful for them in other courses and/or in everyday life.
41	I think the progress of my students is independent of anything I as a teacher might do.
43	In some schools, teaching may suffer because the equipment in the physics classroom is outdated. There is nothing I can do about that as a teacher.
44	I think the general skills my students learn in my class will give them a better chance at success in the future.

Fig. 1: The 31 items of the Perceived Agency Survey that were validated with a panel of 10 experts. The instructions state "in the case of a combined statement, respond to the sentence that is written in bold."

and so we consider in this paper only the remaining 31 items in Figure 1. Teachers in Japan completed the Japanese version of the survey ($N = 32$) from Oct. 2020 – March 2021 over the internet by following a link sent out in an e-mail to physics teachers across the country. The first author administered the German version of the Perceived Agency Survey in person at a week-long professional development event for in-service teachers that took place at the University of Vienna before the Corona pandemic in Feb. 2020 ($N = 61$). The following year, this event took place online, and the first author administered the survey again, explaining that he was investigating whether teacher views had changed as a result of Corona ($N = 32$). To encourage participation, no demographic information, including name, was collected either year.

To further investigate how the perceived agency of teachers was affected by Corona, the first author and a PST (Fuchs, D. 2022) in a BS thesis seminar taught by the first author interviewed a total of five teachers in the Vienna area. With participant consent, these interviews were audio recorded and transcribed.

3. Results

Although our study on perceived agency of in-service teachers is still at an early stage, we can consider our data to look at 1) what effect Corona has had on the perceived agency of teachers, and 2) what differences in perceived agency we find in comparing Austrian and Japanese teachers.

3.1. Effects of Corona on Teacher Perceived Agency

The results of the Perceived Agency Survey are in Figure 2 below. In comparing the gray (Austrian teachers pre-Corona) and orange (Austrian teachers during Corona) bars, we do not find a consistent trend. On some items (Q.1, Q.16, and Q.23), the teachers from the pre-Corona professional development program displayed greater perceived agency (gray bars are longer). On other items (Q.37 and Q.43), the opposite is true. The item with the greatest difference was Q.43: “In some schools, teaching may suffer because the equipment in the physics classroom is outdated. *There is nothing I can do about that as a teacher*,” followed by Q.1: “I will consider carefully what physics textbook to use in my classroom.” Regarding Q.1, we see that the dominant response was to agree (indicating perceived agency) both years, with the gray bar (pre-Corona) being larger (more perceived agency) than the orange bar (during Corona). We must consider the possibility that this difference (as well as the difference on Q43) is just statistical noise being amplified by the small number of respondents. However, the matching item, Q.6, has a bar ranking that is at least consistent: the gray bar is again slightly longer.

Regarding Q.43, we see that the dominant response was to disagree with the statement (indicating perceived agency) both years, but the orange bar (during Corona) is longer than the gray bar (pre-Corona). This is consistent with Q.15, which is the partner item to Q.43: the orange bar is again slightly longer. Table 1 presents a breakdown of responses to Q.1 and Q.43.

Response to Q.43	2020 ($N = 61$)	2021 ($N = 32$)
Disagree*	40 (66%)	25 (78%)
Neutral	10 (16%)	4 (13%)
Agree	11 (18%)	0 (0%)
Left blank	0 (0%)	3 (10%)
Response to Q.1	2020 ($N = 61$)	2021 ($N = 32$)
Disagree	2 (3%)	4 (13%)
Neutral	3 (5%)	5 (16%)
Agree*	56 (92%)	23 (72%)
Left blank	0 (0%)	0 (0%)

Tab. 1: The number and percentage of Austrian teachers who disagreed with, agreed with, or were neutral towards Q.43 and Q.1 (see paper body for item description). An asterisk shows the response indicating perceived agency.

There are numerous possibilities to explain this data. Regarding Q.1, if there genuinely is a difference (and not just statistical noise) between the two years, it may be that the online learning environment which ensued as a result of Corona left teachers feeling powerless (less perceived agency) and with a sense of “learning doesn’t work online anyway, so why should I waste time trying to find good curricular materials?” It is also possible that teachers interpreted “physics textbook” in a sense limited to paper-based books and disagreed with Q.1 because, in an online format, such books are not used as prevalently (and so there is no need to consider which textbook to use). We can similarly speculate about Q.43, where the response indicating perceived agency seems to have increased during Corona. It may be that the necessity of switching to online teaching increased the perceived agency of teachers regarding finding substitutes for outdated equipment in the classroom. Perhaps the experience proved to them that online teaching is a viable alternative, created an opportunity for them to learn about the wealth of computer simulations that exist, and demonstrated to them that learning can happen effectively even without hands-on equipment. It is also possible that teachers in 2021 read the prompt differently than the participants of the survey validation

interviews (conducted prior to Corona) had. Perhaps, during Corona, many teachers read the prompt and thought “well, since learning is taking place online, the bold part of the statement is no longer relevant and I should respond to the first part about teaching

suffering because of equipment. That is not at all the case anymore since my students are not using equipment but rather simulations, so I will disagree with the statement.”

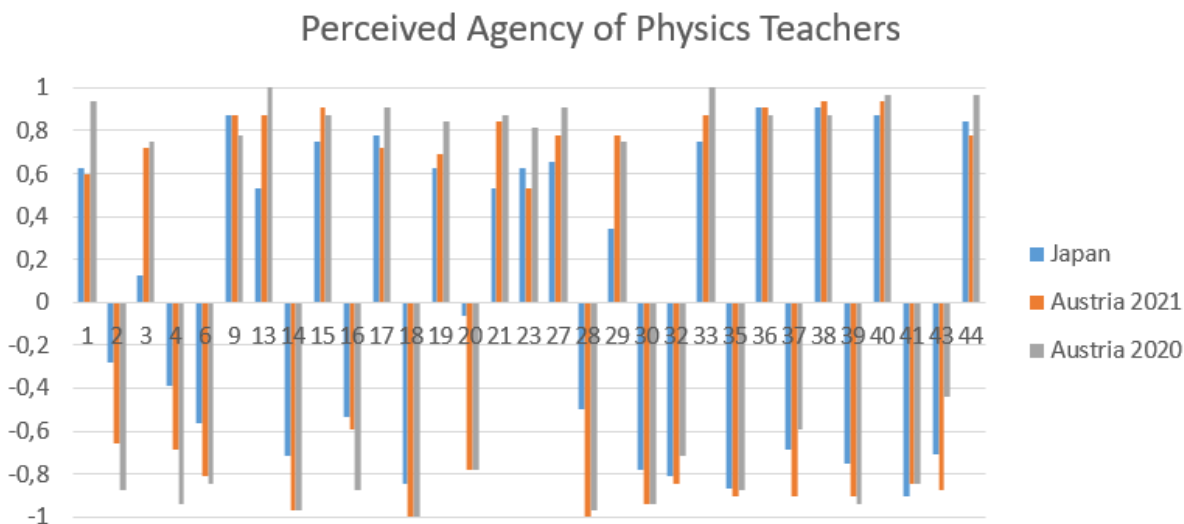


Fig. 2: Mean values from the Perceived Agency Survey. The Austria 2020 data (N = 61) comes from a professional development event that took place before the Corona pandemic, Feb. 2020. The Austria 2021 data (N = 32) comes from the same event that was held online the next year. The Japan data (N = 32) was collected from Oct. 2020 – March 2021. Agreement with a statement is indicated with a “1”, disagreement with a “-1”, and neutral with a “0”. Note that for all three data sets, mean values for each item happen to be in the direction associated with “indicates perceived agency” for that item. Longer bars hence indicate stronger perceived agency.

To gain insight into which, if any, of these speculations might be correct, interview-based case studies would be extremely helpful. Unfortunately, without identifiers on the survey responses, we are unable to follow-up with teachers who changed their minds from 2020 to 2021 in answering these two items (or even know how many teachers did change their minds). Nevertheless, we can look for insight from a free response item that was added to the survey in 2021, asking teachers how they felt their answers had changed since the previous year: “How do your answers compare with those from last year? What is the reason for the changes from last year, if there are changes? (In case you did not fill out the survey last year, try anyway to say something about changes in your situation from last year).” No teachers specifically mentioned any particular item; more compellingly, only one of the N = 32 respondents left a comment consistent with an increased perceived agency regarding what he or she can do so that teaching does not suffer despite outdated equipment (relevant for Q.43): “I have dared to try out new teaching concepts and... simulations”. Similarly, only one response was consistent with a decrease in perceived agency on Q.1, regarding textbook selection and use: “I stick more closely to the textbook”. This suggests that the mixed changes from 2020 to

2021 are, in fact, just statistical noise. This null result is consistent with case study accounts from the interviews conducted as well.

The first author conducted one-on-one semi-structured interviews with two teachers (given the pseudonyms “Macha” and “Ramunay”) in the Vienna area who had participated in the 2021 professional development event and who, at the end of the survey, agreed to a follow-up interview by providing their e-mail addresses. The protocols for these interviews were based upon responses that the participant had given to the Perceived Agency Survey in 2021 that indicated a lack of perceived agency. The interviews themselves were semi-structured, in that priority was given to providing space for the teacher to describe how Corona had affected teaching practices and perceived agency, even when that meant diverging from the protocol.

Regarding Q.1 and Q.6 about textbooks, Macha said that Corona had not affected how Macha feels about textbooks: generally, Macha explained, Austrian textbooks are not particularly helpful and time spent choosing from bad options is wasted. Similarly, Macha’s views about Q.43 and Q.15 had not changed. Macha believed that one can do lots of great experiments without much equipment, and Corona had not affected that view. This stance was echoed by Ramunay. In response to Q.1, Ramunay said that, just

as was the case before Corona, Ramunay carefully considers what physics textbook to use in the classroom, looking first at the photos, and then gathering opinions from colleagues. This is consistent with Ramunay's response to Q.6.

To be clear, we are not claiming that Austrian teachers were altogether unaffected by the changes brought about by online teaching. Macha, for example, when asked explicitly how Corona had changed teaching practices, explained that, because of Corona, it is no longer possible to improvise as well in the moment. When teaching in presence, Macha had been able to bring out experiments from the preparation room in response to ideas students would voice. In an online environment, however, Macha felt a reduced ability to be able to be as responsive to student ideas. Ramunay likewise commented that it is harder to get to know students in an online environment and hence harder to create appropriate lessons. Although older students who are familiar with using a computer and working independently are less of a challenge, "if you have a 10-year old in the first class, it's much more difficult. You don't know them, they, they are a little bit of shy [sic] sometimes, uh, they don't know the computer very well, and you don't know if everything works fine at home, because they are not, uh, they are not used to work at home." Similarly, one of the free responses to the open item at the end of the 2021 Perceived Agency Survey was "Distance learning has made it much more difficult to get a feeling for ... what has not yet been understood. It is more difficult to offer support ...". One of the three teachers D. Fuchs interviewed in his BS thesis ("Latte") confessed to feeling overwhelmed by the new technology involved with online learning that teachers were expected to master and employ. We see these effects, however, as being better aligning with a conceptual dimension closer to self-efficacy than perceived agency. Our scarce data suggests that the "feeling of being in control over what is taught and of how it is taught" (perceived agency) in Austrian teachers is surprisingly stable.

3.2. Comparison of Austrian and Japanese Teacher Perceived Agency

With reference to Figure 2, while no clear trend exists for Austrian teachers in comparing 2020 and 2021 survey responses (and our qualitative data is consistent with the idea that there was no significant change), the perceived agency of Japanese teachers seems to be notably lower than Austrian counterparts on several items. In particular, Q.3 ("If my physics students do not understand what they are learning, I will take more time with the material, even if that means that some planned topics are not taught in class") and Q.20 ("Once I choose a physics textbook for my classroom, I will follow it carefully") demonstrate the most dramatic contrasts between Austrian and Japanese teachers. Regarding the Austrian stance on Q.3, Ramunay went so far in the

interview as to say that it "makes no sense" to push students along if they have not understood an important point:

The problem is that, do I realize that they don't understand it? ... *That's* the problem. If I *do* realize, then of course I take the time, because that makes no sense [to keep going without them understanding], but the main problem is do I realize if they have a problem? [emphasis Ramunay's] ... sometimes I say "OK, [an item on the national curriculum is] not that important, I will skip it."

Although there is need for more extensive research to investigate the extent and causes of these differences on Q.3 and Q.20, it is plausible that responses on these two items are especially strongly correlated. That is, Japanese teachers may hesitate to skip topics to help students who are struggling (disagreeing with Q.3) because they feel a need to carefully follow a textbook (agreeing with Q.20). It is further plausible that both responses stem from a sense of being confined by a demanding national curriculum and entrance exams.

4. Conclusion and Discussion

In this paper, we have presented a small amount of data to suggest two findings. First of all, the perceived agency of Austrian teachers is a fairly stable entity that was affected relatively little by the Corona pandemic. Second, Japanese teachers demonstrate notably less perceived agency than Austrian counterparts, as indicated by the Perceived Agency Survey. This second finding was most striking with Q.3 and Q.20, which concern skipping some planned topics to take time to help struggling students (Q.3) or adhering carefully to the planned curricular materials (Q.20). Taken together, we see that, in comparison to Japanese counterparts, Austrian teachers are more likely to perceive freedom to deviate in their lessons instead of rushing through a large amount of content.

This difference in perception parallels actual differences in the academic systems of the two countries. Whereas Japanese universities are well-known for their competitive entrance examinations, this is not the case in Austria. From our perspective, the national education standards in Japan ("高等学校: 学習指導要領 (平成 30 年告示)," 2018) are indeed more constraining than the counterpart in Austria ("Bundesrecht konsolidiert: Gesamte Rechtsvorschrift für Lehrpläne – allgemeinbildende höhere Schulen," 2021). Table 2 below presents a comparison of required instruction in high school-level physics specific to the topic of mechanics. As an example, both countries require that gravitation be taught to high school students. However, whereas the Austrian education standards only list "gravitation", the Japanese standards specify that students should be able to "understand laws of planetary motion based upon planetary observation data." Since the latter puts more constraints on what the teacher should teach in

the classroom, we have written “understand laws of planetary motion based upon planetary observation data” between asterisks. Overall, we find more constraining (asterisked) items for Japan than for Austria in the Table.

Austria (RIS)	Japan (MEXT)
Relativity of rest and motion	
Change of motion from forces, Newton’s Law of Motion	Relationship between momentum and impulse
Motion in a straight line	*Motion in a plane: velocity and acceleration of curved motion Parabolic movement: motion horizontally projected and obliquely projected objects in relation to linear motion*
Circular motion	Circular motion: centripetal force
Gravitation	*Understand laws of planetary motion based upon planetary observation data*
Conservation of momentum	*Conservation of momentum: conduct experiments on collisions and explosions of objects*
Rotation	Balance of a rigid body: experiments on the balance of large objects
Conservation of angular momentum	
	Simple harmonic motion: conduct experiments on pendulums

Tab. 2: Comparison of national curriculum for mechanics instruction in high school. The asterisks indicate our impression of which topic is more constraining between the two countries.

5. Limitations and Future Work

In this paper, we have presented the limited data that we have regarding the perceived agency of in-service teachers. Due to a small number of responses to our Perceived Agency Survey, it was necessary to restrict our analysis to descriptive statistics. Although, as we mentioned earlier, we would welcome the opportunity to collect additional survey responses to conduct Rasch analysis, we have generally found that teachers are reluctant to take time out of their busy schedules—particularly in Japan—to complete our survey. Furthermore, as it is impossible to acquire additional “pre-Corona” data, there is not much we can do to strengthen our claims about the effect that Corona has had on perceived agency. Nevertheless, the findings presented here serve to motivate a future

study that would capitalize upon the pre-Corona data that we have from pre-service teachers that was discussed in earlier work (Hull & Uematsu, 2020a). Specifically, we hypothesize that Austrian teachers changed little in their perceived agency because the perceived agency that they had gave them support to maintain that perceived agency. In other words, we hypothesize that teachers (and PSTs) who have a higher degree of perceived agency are more stable in that perceived agency. We can test this by returning to collecting data from PSTs in Austria and Japan and seeing how patterns on the Perceived Agency Survey compare for the two populations today in comparison to what we found prior to Corona. We hypothesize that we will see little change in the Austrian PSTs (who, on average, had a notably greater perceived agency) in comparison to Japanese counterparts.

6. Literature

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