JOURNAL OF BALTIC SCIENCE EDUCATION

ISSN 1648-3898 /Print/
ISSN 2538-7138 /Online/

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DOMAIN-DIFFERENTIATED RESEARCHER REPRESENTATIONS AND FUTURE OCCUPATIONAL ASPIRATIONS OF SCIENCE-GIFTED STUDENTS

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Abstract. *The Draw-A-Scientist Test (DAST) has repeatedly shown that students hold a single, stereotyped image of the scientist, a middle-aged white man in a lab coat working alone indoors. This study asked whether that singular image holds when science-gifted students are prompted to draw an expert in their own field and when their drawings are considered alongside their envisioned occupational futures. A total of 128 science-gifted students (grades 6–8; 98 boys, 30 girls) from nine specialization tracks at a university-affiliated science-gifted education institute completed a modified DAST, asking them to draw a researcher from their own field showing "where, with what tools, and doing what," together with open-response items on their hoped-for occupation and future aspirations. Drawings were coded using a developmentally and domain-adapted three-layer scheme (classic stereotype markers; figure representation; domain-specific practice), and future-self-related responses were coded for occupational science linkage, aspiration orientation, and learning needs. Classic stereotype indicators were rare, while domain-related research practices were represented. Researcher representations also differed across specialization domains, particularly in research activities. Most students named a STEM-related future occupation, and their aspirations focused on social contribution and the pursuit of knowledge. Researcher representations and envisioned occupational futures showed partial alignment at the domain level.*

Keywords: *domain differentiation, Draw-A-Scientist Test, gifted science education, occupational aspirations, researcher representations, science-gifted students*

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Introduction

Students' images of scientists are relevant to how they perceive and engage with science. The mental image of "who does science" is tied to students' attitudes towards science, their sense of belonging in scientific settings, their willingness to participate, and ultimately their educational and occupational choices (Carlone & Johnson, 2007; Finson, 2002). In the Korean context, Song and Choi (2018) have also examined images of scientists alongside perceptions of science-related careers, highlighting the relevance of such representations to career perceptions. For more than half a century, this image has been examined through a single task, drawing a scientist, and findings have shown recurring patterns across time and culture: a middle-aged white man in a lab coat, working alone indoors with chemistry apparatus (Chambers, 1983; Miller et al., 2018). The persistence of this image may have implications for how students view participation in science. If the culturally available picture of a scientist is narrow and exclusionary, then students who do not see themselves in it may conclude, however implicitly, that science is not for them. In this article, "scientist" refers to the generic figure examined in the traditional DAST literature, whereas "researcher" refers to the domain-specific expert elicited by the modified prompt used in the present study.

This concern is especially relevant for talent development among science-gifted students. For this population, researcher representations may be considered not only as cultural stereotypes but also in relation to the future selves students envision. Examining researcher representations alongside students' stated future aspirations may therefore provide insight into the relationship between disciplinary images and future-self orientations. How science-gifted students represent researchers in their own disciplines

https://doi.org/10.33225/jbse/26.25.870

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

may therefore be relevant to their imagined future participation in science. However, the instrument most often used to study scientists' images was not designed for this population or this question. It was designed to measure how far general students have absorbed a generic adult-scientist stereotype, and to summarize that absorption in a single score.

Two assumptions embedded in this design require further consideration. The first is that "the scientist" is a single image. However, science is not one activity; the chemist at a bench, the field geologist, the mathematician at a chalkboard, and the programmer at a screen engage in different practices with different tools in different settings. If students who specialize in these fields represent researchers differently across disciplines, then a generic scientist prompt may obscure domain-specific representations that become visible when students are asked to depict researchers in their own fields. The second assumption is that the drawn scientist is an image of a distant other. However, when the person depicted is an expert in the respondent's field, the resulting representation may become relevant to how the student imagines participating in that field and to the occupational future the student envisions. This does not mean that the drawing constitutes a direct self-representation; rather, it can be examined alongside the student's stated occupational aspirations to explore potential alignment between researcher representations and envisioned occupational futures.

The present study addresses this gap. Using a modified Draw-A-Scientist Test that asks science-gifted students to draw a researcher from their own field and to describe the occupational future they envision, the study examines (a) how far the drawn image departs from the classic stereotype, (b) how the scene, tools, and activity differ across specialization domains, and (c) whether the researcher representations students draw show domain-level alignment with the occupational futures they envision. The study is situated within the DAST tradition, the literature on the domain specificity of scientist images, and the constructs of science identity and possible selves, which provide the theoretical framework for the analysis.

Theoretical Framework

The Draw-A-Scientist Tradition and Its Premises

The study of scientists' images began with Mead and Métraux (1957), who collected high-school students' written descriptions and distilled a composite portrait of a lab-coated man working indoors. Chambers (1983) recast this as a projective drawing task for children, analysing 4,807 drawings from kindergarten through grade 5 in three countries and identifying seven recurring indicators: lab coat, eyeglasses, facial hair, symbols of research, symbols of knowledge, technology, and relevant captions. Finson et al. (1995) extended these into the 14-item Draw-A-Scientist Checklist (DAST-C), adding male gender, Caucasian ethnicity, older age, indoor work, danger, secrecy, and mythic imagery; DAST-C scores each indicator as present or absent and sums them, with reported inter-rater reliability of .94–.98 (Finson, 2002). Across five decades and many cultures, the composite has remained relatively stable (Finson, 2002; Türkmen, 2008), and in Korea it has been documented repeatedly among students and teachers alike (Kwon, 2005; Lee & Park, 2010; Lim et al., 2008; Song & Kim, 1999). Some change has been noted. In a meta-analysis of five decades of U.S. studies, Miller et al. (2018) found that the proportion of children drawing female scientists had increased over time. Kim et al. (2002) showed that a "Meeting with Scientists" intervention reduced some stereotyped markers, indicating that the image is a historically contingent construct rather than a fixed constant.

Three premises underlie this tradition. Respondents are typically general students with no assumed disciplinary expertise; the target is a generic adult scientist with no specified field; and results are often summarized as a single total score intended to indicate how stereotyped the depicted scientist's image is. Each premise has been questioned. Symington and Spurling (1990) argued that a "draw a scientist" instruction elicits a public stereotype rather than a respondent's own view, and proposed a revised prompt (DAST-R); Farland-Smith (2012) developed a modified DAST and rubric to improve scoring reliability and dimensionality. Methodological critiques have questioned whether a single DAST-C total score adequately captures the heterogeneous features represented in students' drawings and have highlighted the need to consider contemporary, contextual, and task-related influences on drawing content (Ferguson & Lezotte, 2020; Reinisch et al., 2017). Together, these critiques support separating appearance-based stereotype indicators from indicators of research practice, rather than combining them into a single score.

https://doi.org/10.33225/jbse/26.25.870

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Domain Specificity of the Scientist Image

Because science comprises heterogeneous fields with distinct objects, methods, tools, and settings, the "scientist" students picture may vary with the field in view. Evidence for such differentiation is accumulating. Studies that distinguish occupations show that students hold different images of scientists, engineers, and technicians (Jung & Kim, 2014; Kim et al., 2012), and instrument variants have targeted specific fields or activities: Picker and Berry (2000) examined images of mathematicians, Christidou et al. (2012) analysed the activities depicted in adolescents' drawings of researchers, and Meyer et al. (2019) compared images across university faculties. Most directly, Kim and Bae (2025) developed a Draw-A-Biologist Test (DABT) whose checklist adds "research steps" and "research materials" to appearance indicators, an approach that, like the present one, separates appearance stereotypes from research practice, though it targets a single discipline. The recurrent observation that students, when asked to draw a generic scientist, tend to draw something resembling a chemist (Finson, 2002) may itself reflect a laboratory image standing in for science as a whole. Crump (2024) reported a similar pattern: even science undergraduates, when asked to imagine a scientist, reproduced a generic chemistry lab stereotype rather than drawing their own field, showing that whether respondents draw their discipline is sensitive to both the prompt and the population. These lines of work suggest that specifying the respondent's field, rather than leaving the target generic, may reveal domain-differentiated images that a single prompt conceals.

Science Identity, Possible Selves, and Researcher Representations

When students are asked to depict an expert in their own field, the resulting representation may reflect how they imagine participating in that field. However, the drawing should not be treated as a direct self-portrait. Two constructs help frame this potential connection. Possible selves, the selves one might become, would like to become, or is afraid of becoming (Markus & Nurius, 1986), provide a framework for understanding students' stated future occupations and aspirations as expressions of their future-oriented thinking. Science identity, involving competence, performance, and recognition in relation to science (Carlone & Johnson, 2007), offers a complementary lens for examining how students position themselves within scientific fields and careers. In the present study, these frameworks are used interpretively to examine the alignment between students' researcher representations and their envisioned occupational futures, rather than to claim that either a science identity or a researcher self was directly measured. Occupational aspirations, in this sense, provide one indication of a developing future orientation towards or away from scientific work (Gottfredson, 1981). The gender of the drawn figure is likewise treated cautiously: gender congruence may indicate the availability of a same-gender researcher representation, but it is not taken by itself as evidence of identification with the depicted researcher.

For science-gifted students, the limited evidence available suggests that their representations of science may show greater disciplinary variety and elaboration than those of general students. Ahn and Yoo (2012) compared career awareness, science preference, and stereotyped scientist images between gifted and non-gifted elementary students, and Lee and Kang (2015) reported that science-gifted students' imaginative science drawings integrated more disciplines and settings and were more elaborate than those of general students. These findings raise the possibility that, when prompted within their own specialization domains, science-gifted students may produce researcher representations organized around domain-related practices and potentially related to their occupational aspirations.

Research Aims and Research Questions

Based on this literature, no study has examined, within a single specialized sample, how domain-differentiated researcher representations relate to students' envisioned occupational futures. The present study does so by applying a modified DAST to science-gifted students across nine specialization tracks and analysing their drawings alongside their stated occupational futures through a science-identity and possible-selves lens. The instrument modifies the classic DAST in three ways: in population (science-gifted students rather than general students), in target (an expert in the respondent's own field rather than a generic scientist), and in depictive focus (eliciting scene, tools, and research activity rather than only a figure's appearance). In the analysis, the single DAST-C total is replaced with a layered coding scheme that keeps appearance stereotypes, figure representation, and domain practice separate, and categorical coding is added for students' hoped-for occupation and aspirations.

The study is guided by five research questions:

https://doi.org/10.33225/jbse/26.25.870

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

RQ1. To what extent do science-gifted students' drawn researcher images display classic scientist-stereotype indicators?
RQ2. How is the human figure represented in terms of presence, gender, and congruence with the student's own gender?
RQ3. How do the scenes, tools, and research activities of the drawn researcher differ across specialization domains?
RQ4. What future-self orientations do science-gifted students express through their hoped-for occupations, aspiration orientations, and perceived learning needs, and how do these patterns vary across domains?
RQ5. To what extent do students' researcher representations align with their envisioned occupational futures at the domain level?

Research Methodology

General Background

This study employed a cross-sectional, mixed-methods design that combined quantitative coding of drawings with categorical and interpretive analysis of the students' short open responses. Data were collected in 2026 during a nature-of-science and career-education program conducted as part of the regular curriculum at a university-affiliated science-gifted education institute. Because the prompt was domain-relevant and the sample specialized, the analysis focused on within-sample comparison across specialization domains rather than comparison to external DAST norms. The design was descriptive-interpretive: it characterized researcher representations and future-self-related responses in a specialized population and examined their descriptive alignment. The analysis was informed by the concepts of science identity and possible selves, which were used as interpretive frameworks rather than as directly measured constructs.

Participants

Participants were 128 science-gifted students (98 boys, 30 girls) enrolled at a university-affiliated science-gifted education institute that admits students through a multi-stage selection process. Students were grouped according to the program level in which they were enrolled. Grade 6 students in the elementary-level program were enrolled in mathematics, science, or integrated-science tracks; students in the secondary-level program (grades 7–8, predominantly grade 7) were enrolled in physics, chemistry, biology, earth science, informatics, or mathematics tracks. The full domain-by-gender distribution appears in Table 1. Boys outnumbered girls (76.6% vs. 23.4%), with particularly skewed ratios in physics, chemistry, earth science, and mathematics. Data were drawn from a survey administered during regular instruction; respondents' names were replaced with anonymized domain-plus-number identifiers, and no identifying information was retained in the dataset used for analysis. The materials analysed in this study were worksheets that the students completed during a nature-of-science and career-education program conducted as part of the regular curriculum at the gifted-education institute. The students and their parents were informed in advance that the worksheets would be used for research, and their consent was obtained before the data were analysed. Following the analysis, the researchers held a follow-up session to explain the findings to the participating students, so that the results could also be discussed in an educational context.

Table 1
Participants by Specialization Domain and Gender

Level	Domain	Boys	Girls	Total
Elementary (6)	Mathematics	13	3	16
	Science	10	8	18
	Integrated	12	4	16

https://doi.org/10.33225/jbse/26.25.870

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Level	Domain	Boys	Girls	Total
Secondary (7–8)	Physics	13	2	15
	Chemistry	10	1	11
	Biology	10	4	14
	Earth science	9	2	11
	Informatics	10	4	14
	Mathematics	11	2	13
Total		98	30	128

Instrument

The study used a researcher-developed educational worksheet, "Exploring the Life of a Scientist and My Future." It comprised four parts: (I) background information (domain, grade, gender, favourite subject, favourite activity, hoped-for future occupation); (II) a modified DAST drawing item; (III) open-response items describing the drawing; and (IV) career-connection items. The Part II prompt read: "Freely draw an expert conducting research or inquiry in your own field (science, mathematics, IT, etc.)," with the note, "Show specifically where this person is, what tools they use, and what they are doing." Part III asked for the researcher's specific activity (3-1) and three key words (3-2). Part IV asked students to imagine themselves 20 years in the future and describe what problem they would solve (4-1) and what they would most want to learn to become a successful researcher (4-2). The worksheet was not intended to function as a standardized psychometric scale or diagnostic test. Rather, it was designed to elicit drawings and short open-ended responses for descriptive and interpretive analysis. Accordingly, the study did not calculate scale-based psychometric properties such as internal consistency; instead, reliability was assessed at the coding stage through independent inter-rater agreement.

Following Symington and Spurling (1990), specifying the respondent's own field was intended to reduce reliance on a generic public image of "the scientist" and to elicit representations situated within a familiar disciplinary context. At the same time, because drawing prompts can themselves shape what participants depict (Reinisch et al., 2017), the resulting domain differentiation was interpreted as differentiation elicited under a domain-relevant prompt rather than as direct evidence of students' domain-specific conceptions independent of the task. Unlike Farland-Smith's (2012) approach, which deliberately distances the drawer from the figure, the present prompt was intended to activate domain relevance. The accompanying note, "where, with what tools, and doing what," was designed to foreground research practice; accordingly, scene, tool, and activity were analysed as features of the elicited representation rather than as prompt-independent attributes of students' conceptions of scientists.

Coding Framework

Drawing. DAST-C's 14 indicators were reorganized into three layers, and domain-specific practice indicators were added (Table 2). The Caucasian indicator (original item 9) was omitted because racial or ethnic identity could not be reliably inferred from the monochrome pencil drawings. Layer A (classic stereotypes, for comparison) comprised eight classic stereotype indicators: lab coat, eyeglasses, facial hair, all-male figure, older age, mythic imagery, secrecy, and danger (0–8). Layer B (figure representation) coded figure presence, figure gender (male/female/unmarked), and congruence with the student's own gender. Layer C (domain-specific practice) comprised a situated-practice indicator count (research tools, knowledge symbols, technology, captions, and indoor setting; 0–5), together with scene type (six categories), tool category (six categories), and research-activity type (nine categories coded from the 3-1 text). The indicator count was used as a descriptive summary of the number of practice-related features depicted and was not treated as a validated unidimensional scale.

https://doi.org/10.33225/jbse/26.25.870

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Table 2
Adapted the Three-Layer Coding Framework for the Drawings

Layer	Components	Interpretive focus
A. Classic stereotypes (comparison)	Lab coat, eyeglasses, facial hair, all-male figure, older age, mythic imagery, secrecy, danger (summed 0–8)	Absence/attenuation of the adult stereotype
B. Figure representation	Figure presence; figure gender; own-gender congruence	Who is depicted and how gender is represented
C. Domain-specific practice	(i) Situated-practice indicator count (tools, knowledge symbols, technology, captions, indoor; 0–5); (ii) scene type; (iii) tool category; (iv) research-activity type	Domain differentiation of the researcher's image

Future-Self Orientations. Future-self orientations were examined through three response dimensions: hoped-for occupation, aspiration orientation, and perceived learning needs. Hoped-for occupation was coded for science-linkage as STEM-research (scientist, researcher, astronomer, etc.), STEM-applied (engineer, developer, physician, veterinarian, etc.), quasi-science/education (teacher, professor), or non-science/undecided. Aspiration orientation (4-1) was coded as knowledge pursuit, social/humanitarian contribution, technological development, personal achievement, national/economic, or other. Learning needs (4-2) were coded as knowledge/expertise, skills/competencies, disposition, or other. These responses were treated as indicators of future-self orientations rather than as a direct psychometric measure of possible selves.

Coding Procedure and Inter-rater Reliability

A coding manual with operational definitions and boundary examples guided all coding. Two trained researchers independently coded the drawings and open responses before discussing any disagreements. Inter-rater reliability was assessed for the major coding variables prior to consensus. Cohen's κ was calculated for nominal categorical variables, including scene type, tool category, research-activity type, occupational science linkage, aspiration orientation, and learning needs, as well as for binary indicators where κ could be estimated. For indicators with no or extremely limited variation, for which κ was not estimable or potentially unstable, percentage agreement was also examined. After an independent reliability assessment, all disagreements were resolved through discussion, resulting in the final consensus-coded dataset used in the analyses. Independent inter-rater agreement was κ = .95; DAST-C studies have reported κ values ranging from .94 to .98 (Finson, 2002).

Data Analysis

Descriptive statistics summarized the prevalence and means of each indicator. Categorical distributions were examined using contingency tables. For the domain comparison of research activity, the nine activity categories were collapsed into four broader families to reduce sparse cell counts: empirical investigation (experiment/synthesis, observation/measurement, and field/exploration), computational/theoretical activity (calculation/proof/theory and coding/AI development), applied/intervention activity (design/engineering and diagnosis/clinical), and documentation/other (documentation and other). Because expected cell counts remained small in the domain-by-activity table, statistical significance for this comparison was assessed using a Monte Carlo permutation test based on the Pearson χ^2 statistic (100,000 permutations). Effect size was reported using Cramér's V. Other categorical patterns with sparse cells were interpreted descriptively unless an appropriate inferential test could be supported. The alpha level was .05. Because several domains had small cell sizes (n = 11–18), test results were interpreted conservatively and accompanied by qualitative descriptions. Alignment between researcher representations and envisioned occupational futures was examined descriptively by comparing the research activities depicted in students' drawings with their stated hoped-for occupations and by identifying cases in which the two reflected similar disciplinary practices or fields.

The qualitative analysis was used to interpret the quantitative patterns in context. Working from the full set of Part III and Part IV responses, the two researchers read each response, assigned initial descriptive codes, and grouped these into the activity, aspiration, and learning-need categories reported below, retaining participants'

https://doi.org/10.33225/jbse/26.25.870

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

verbatim wording throughout. Drawings were additionally read interpretively for recurring domain-related patterns, characteristic pairings of scene, tool, and activity, identified through constant comparison across domains. Cases reproduced here were selected to illustrate recurring domain-related patterns rather than to index their frequency. The two researchers jointly selected representative cases that most clearly reflected the recurring combinations of scene, tool, and activity identified within each domain. Participants' responses were quoted in their own words, translated from Korean, and identified by anonymized domain-plus-number labels (e.g., Informatics-01). Five representative drawings are reproduced in Figure 1, with identifying header information removed.

Research Results

Classic Stereotype Markers

The eight classic stereotype indicators summed to $M = 0.27$ ($SD = 0.55$) across the sample. Facial hair, all-male figure, older age, and secrecy were absent (0%); mythic imagery and danger appeared once each (0.8%), while lab coat and eyeglasses each appeared in 12.5% of drawings (Table 3). The classic DAST stereotype of an older male scientist in a lab coat was therefore virtually absent when science-gifted students drew a researcher from their own field.

Table 3
Prevalence of Classic Stereotype Markers (N = 128)

Marker	%	Marker	%
Lab coat	12.5	Mythic	0.8
Eyeglasses	12.5	Danger	0.8
Facial hair	0.0	Secrecy	0.0
All-male figure	0.0	Older age	0.0

Figure Representation and Gender

A human figure appeared in 124 drawings (96.9%); four students drew only tools and environment. Figure gender was unmarked in 112 cases, female in 12, and explicitly male in none. Of the 12 female figures, 10 were drawn by girls, so that girls who marked gender drew female researchers, including girls in male-skewed domains (physics, chemistry, mathematics).

Domain Differentiation of the Researcher Image

In contrast to the near-absent classic stereotype indicators, the situated-practice indicator count was relatively high ($M = 2.59$, $SD = 0.98$, on a 0–5 scale). Scene types were distributed across laboratory (35.9%), computer/digital (17.2%), office/study (14.8%), abstract/none (14.1%), field/outdoor (13.3%), and chalkboard/classroom (4.7%), with distributions varying across specialization domains. Domain-related variation was also observed in lab coats, research tools, technology, and indoor settings. Tool categories were distributed across computer/digital/machine (44), wet-lab glassware (33), chalkboard/formula/document (18), telescope/field gear (14), other/none (11), and microscope/optics (8).

Research-activity type, coded from the 3-1 descriptions, was distributed across experiment/synthesis (35), coding/AI development (20), observation/measurement (18), design/engineering (15), calculation/proof/theory

https://doi.org/10.33225/jbse/26.25.870

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

(11), diagnosis/clinical (7), field/exploration (4), documentation (4), and other (14). For the domain comparison, these nine categories were collapsed into the four activity families defined above. Research-activity family differed significantly across specialization domains, $\chi^2(24) = 43.99$, Monte Carlo $p = .007$, Cramér's $V = .34$. Informatics was dominated by computer/coding scenes and technology; chemistry by laboratory settings and wet-lab tools; biology by microscope, dissection, and clinical imagery; earth science by field and observational imagery; and physics and mathematics by chalkboard and symbolic representation. Earth science had the lowest situated-practice indicator count ($M = 1.91$), reflecting the fact that several field- and observation-oriented features were not captured by a count that includes indoor and instrument-related indicators.

Table 4
Research-Activity Type by Domain (Frequencies)

Domain	Exp./synth.	Obs./meas.	Calc./theory	Design/eng.	Coding/AI	Clinical	Other
E-Math	3	1	5	1	1	2	3
E-Science	6	3	0	4	0	1	4
E-Integrated	3	4	0	4	4	0	1
Physics	5	1	2	1	3	0	3
Chemistry	6	2	1	1	0	0	1
Biology	4	4	0	1	0	3	2
Earth science	3	3	0	1	0	0	4
Informatics	2	0	0	2	9	0	1
Mathematics	3	0	3	0	3	1	3

Note. The "Other" column combines field/exploration, documentation, and other activities; all nine categories appear in the text. Domain differences were tested on four collapsed activity families (see Data Analysis).

Read together, these distributions correspond to recognizable domain-related patterns, five of which are illustrated in Figure 1. In informatics, students placed the researcher at a screen: Informatics-01 (grade 7) drew a figure in front of a monitor and described the work as "making a robot that carries objects far away accurately and safely" (keywords: computer, drone, robot). Chemistry drawings were organized around the bench and its glassware; Chemistry-05 sketched a lab-coated figure beside a reaction and a whiteboard bearing the equation for "the products of the reaction of sodium and potassium with water." Biology drawings foregrounded the observation of living material. Biology-01 drew a researcher at a microscope and described the work as "finding or making a solution that can regenerate or destroy cells." In contrast, an integrated-science student (Integrated-01, grade 6) moved the scene outdoors entirely, drawing an astronomer on a hillside "observing and studying the stars through a telescope, their features and their beauty." Physics and mathematics were represented instead through chalkboard-based and symbolic imagery: Physics-02 drew a figure writing $E = mc^2$ to "set up a hypothesis" (keywords: physics, chalkboard, Einstein). The five examples illustrate contrasting domain-related patterns, ranging from laboratory and microscope-based work to field observation, digital activity, and theoretical representation.

https://doi.org/10.33225/jbse/26.25.870

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Figure 1

Representative Domain-Related Patterns in Science-Gifted Students' Drawings of a Researcher



(a) Informatics — digital/computer

(b) Chemistry — wet-lab experiment

(c) Biology — microscope / cell study

(d) Integrated (astronomy) — telescope, outdoors

(e) Physics — chalkboard / symbolic

Note. Panels show representative drawings selected to illustrate recurring domain-related combinations of scene, tool, and activity: (a) informatics, (b) chemistry, (c) biology, (d) integrated science (astronomy), and (e) physics. Part I header information, including names, has been removed to preserve anonymity.

https://doi.org/10.33225/jbse/26.25.870

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Future Occupational and Aspiration Orientations

Students' future-self-related responses showed a clear orientation towards STEM-related occupations. Seventy percent named a STEM occupation (STEM-research 39, STEM-applied 51), with 27 non-science/undecided and 11 quasi-science/education. Occupational patterns also varied descriptively across domains. Informatics students frequently named applied STEM occupations such as developer, programmer, AI engineer, and security specialist; earth-science students more often named research-oriented occupations such as astronomer and geoscientist; and chemistry students also commonly named applied STEM occupations. Aspiration orientation (4-1) centred on social/humanitarian contribution (56; 43.8%), curing disease, protecting the environment, solving energy problems, followed by knowledge pursuit (34; 26.6%), technological development (17; 13.3%), personal achievement (3), national/economic goals (1), and other (17). Learning needs (4-2) were distributed across knowledge/expertise (51), skills/competencies (40), disposition (20), and other (14); three students did not respond.

The open responses provided further detail on the content of these aspirations. Contribution-oriented responses emphasized solving shared societal problems: curing disease (Biology-01 hoped to become "someone who can destroy cancer cells, or change their makeup to make them beneficial," and E-Math-05 imagined "making the vaccine that defeats a virus when one appears"), protecting the planet (Mathematics-10 wanted to "solve the Earth's pollution problem, achieve carbon neutrality, and put conservation into practice"), and meeting basic human needs (Integrated-09 named "treatments and machines that solve the world's disease and hunger problems"). Knowledge-pursuit responses focused more on questions of scientific understanding: Physics-02 asked "whether dark matter exists [and] whether white holes exist," and Integrated-01 wished to uncover "the secrets of the stars that people have not yet found." Technology-oriented students instead described an artifact to be built, as when Informatics-01 proposed "drones that move on a person's voice command so they are easy to use."

Alignment Between Researcher Representations and Occupational Futures

Researcher representations and envisioned occupational futures showed partial alignment at the domain level. Descriptively, this correspondence was most evident in informatics, where digital scenes and coding-related activities were frequently accompanied by aspirations towards developer- and computing-related occupations. Similar drawing–occupation correspondences were observed in several individual cases across other domains, although such alignment was not consistent across all students. Accordingly, the relationship between researcher representations and occupational futures was interpreted descriptively and was not treated as evidence of a statistically established relationship.

The alignment was most apparent in individual cases where a student's drawing and stated occupational future reflected the same domain-specific practice. Informatics-01 drew a figure coding at a screen and named a "drone developer / IT developer" as her hoped-for occupation; Chemistry-05 drew a bench reaction and named an "organic/inorganic chemist"; and Integrated-01 drew an astronomer at a telescope and named "astronomer." Occasionally, students made the connection between the depicted researcher and their own future explicit. For example, Informatics-02 wrote that "if the researcher in my drawing were me in 20 years, I would be someone who uses ICT to solve society's problems," providing an explicit example in which the student connected the depicted researcher with a future occupational role. In some cases, drawing and occupation diverged across a research/applied boundary within the same field, as when a physics student who drew a chalkboard theorist chose an aerospace engineering career.

Discussion

De-stereotyping and the Domain-Relevant Prompt

The near-absence of classic stereotype indicators may reflect characteristics of the specialized science-gifted sample, the domain-relevant prompt, or both. Asking students to depict an expert in their own field may have shifted attention away from a generic public image of "the scientist" towards representations associated with familiar disciplinary contexts. The two factors cannot be separated in this design and would need to be examined in future studies by comparing different student populations and prompt conditions. The finding parallels Türkmen (2008), who reported attenuated stereotypy alongside more casual clothing, smiling, and computers, and differs from Crump (2024), whose science undergraduates reproduced a generic chemistry stereotype rather than their

https://doi.org/10.33225/jbse/26.25.870

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

own field. This contrast suggests that the domain-relevant prompt may have contributed to the attenuation of classic stereotype indicators observed in the present study. It also contrasts with the strongly stereotyped Korean profiles reported in general samples (Lim et al., 2008). However, the present design does not allow the relative contributions of population and prompt to be determined. At the same time, the absence of classic stereotype indicators should not be interpreted directly as evidence of de-stereotyping, because adult or negative elements may have been less salient under the present task conditions.

Gender and the Practice-Centred Figure

That no student drew an explicitly male scientist and that 10 of the 12 explicitly female figures were drawn by girls are consistent with previous evidence that students often depict scientists of their own gender, including Crump's (2024) finding that 42% of female undergraduates drew female scientists. Female researchers were depicted even among girls enrolled in male-skewed study domains within the sample, such as physics, chemistry, and mathematics, suggesting that female researchers were represented in this sample. The absence of gender differences in stereotype markers echoes Kim and Bae (2025), who found no significant gender difference in the summed appearance/working-condition score ($t = -0.178$, $p = .859$). However, because most figures were gender-unmarked, the findings should not be interpreted as evidence that male bias had disappeared. Rather, gender was not strongly foregrounded in most of these practice-centred representations.

Domain Differentiation under a Domain-Relevant Prompt

The richness of practice-related features relative to appearance markers suggests that, under the present prompt, students' representations were organized primarily around what researchers do rather than how they look. Scene, tool, and activity showed clear domain-related patterns across specialization domains, producing recognizable patterns such as digital- and coding-oriented representations in informatics, wet-laboratory representations in chemistry, and field- or observational-oriented representations in earth science. These patterns suggest that a domain-relevant prompt can elicit differentiated representations of research practice rather than a single generic pattern.

This pattern should not, however, be interpreted as evidence that the observed domain differentiation exists independently of the elicitation task. The prompt explicitly directed students to portray an expert in their field and to show where that person works, what tools they use, and what they are doing. Previous methodological critiques of drawing-based measures have emphasized that such prompting can influence the content of the resulting drawings (Reinisch et al., 2017). Accordingly, the present study cannot determine whether the same degree of domain differentiation would emerge under a conventional generic DAST prompt. The findings, therefore, describe the representations elicited by a domain-relevant prompt rather than those that would necessarily emerge from a generic prompt.

This finding also has methodological implications. The frequent laboratory-centred image found in generic DAST studies may partly reflect what becomes salient when science is presented as an undifferentiated category. In the present study, once students were explicitly situated within their specialization domains, laboratory, digital, field-observational, and theoretical-symbolic forms of research were all represented. This extends the single-discipline approach of Kim and Bae (2025) by demonstrating the range of disciplinary representations observed across multiple domains in response to the present prompt. The relatively low situated-practice indicator count for earth science further suggests that a descriptive count that includes indoor and instrument-related indicators may underrepresent field- and observation-oriented forms of research practice.

Future Selves and the Alignment of Researcher Representations

These findings can be considered in relation to possible selves and science identity, although neither construct was directly measured in this study. That 70% of students named a STEM occupation, and those aspirations centred on social/humanitarian contribution and knowledge pursuit, with relatively few responses coded as personal achievement or national/economic goals, suggests that many students envisioned scientific work as contributing to society and pursuing understanding. From a possible-selves perspective (Markus & Nurius, 1986), these responses may reflect students' future-oriented aspirations in addition to their stated occupational preferences.

https://doi.org/10.33225/jbse/26.25.870

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

The partial correspondence between students' drawings and their stated occupational futures further suggests that, in some cases, both reflected similar disciplinary contexts. This pattern was most apparent in informatics, where digital scenes and coding activities frequently accompanied aspirations towards developer- and computing-related occupations. Such alignment should not be taken as evidence that the drawing itself constitutes a researcher-self; rather, it shows that some students represented research practice and future occupations within similar domain-specific contexts.

Across domains, the representations observed in this study included recurring patterns such as digital development work in informatics, wet laboratory experimentation in chemistry, observational and biomedical work in biology, field-based observation in earth science, and theoretical or symbolic work in physics and mathematics. Future studies should examine whether domain-relevant researcher representations are related to the development of occupational aspirations. Longitudinal research would be needed to determine whether such representational alignment becomes more stable over time or contributes to the development of a more consolidated science-related identity.

Implications

Methodologically, a developmentally and domain-adapted layered coding scheme provided information that was not captured by a single DAST-C total score: the near-absence of appearance stereotypes and the richness of practice markers surfaced only when the two were kept separate, echoing measurement critiques of the total score and suggesting the value of considering domain-level patterns alongside overall stereotype scores, particularly for specialized populations. Educationally, because students' researcher representations and occupational aspirations showed domain-related patterns, career and identity guidance that reflects the authentic practices and pathways of different fields—rather than presenting a single generic image of "the scientist"—may be more meaningful for science-gifted students. The modified DAST may serve as a formative activity to elicit students' researcher representations and prompt reflection on how those representations relate to their future occupational aspirations. However, its educational utility would require further evaluation. Although the study was conducted in a Korean science-gifted education context, the methodological issue is relevant beyond Korea. Disciplinary context and prompt design may also influence drawing-based measures used in other educational settings.

Conclusions

When science-gifted students drew an expert from their own field and described their envisioned occupational futures, three findings emerged. First, classic stereotype indicators were nearly absent under the domain-relevant prompt, and no explicitly male researcher was depicted. Second, researcher representations showed clear domain-related patterns in practices, scenes, tools, and activities across specialization domains. Third, students' envisioned occupational futures were strongly STEM-oriented (70% named STEM occupations), frequently emphasized contribution and inquiry, and showed partial descriptive alignment with the practices represented in their drawings. Taken together, these findings suggest that a domain-relevant elicitation can reveal differentiated representations of research practice and descriptive correspondences with students' occupational aspirations. Rather than establishing a distinct domain-specific researcher-self, the present study documents partial descriptive alignment between researcher representations and envisioned occupational futures, with methodological implications for drawing-based measures in specialized student populations and educational implications for domain-sensitive career guidance.

Several limitations should be noted. Most importantly, domain and prompt are intentionally coupled in the present design: students were explicitly asked to depict a researcher in their own specialization and to specify the setting, tools, and activity. Consequently, the observed domain differentiation cannot be attributed solely to pre-existing domain-specific conceptions, because the elicitation itself may have contributed to making disciplinary features salient. A future design comparing a conventional generic DAST prompt with a domain-specific prompt would allow the effect of domain framing to be examined directly. The present findings should therefore be understood as demonstrating domain-differentiated representations under a domain-relevant elicitation condition rather than as establishing that students would spontaneously produce the same differentiation under a generic scientist prompt. The sample was drawn from a single institution. It included small, domain-specific subsamples and a skewed gender ratio, which limited statistical power and generalizability, particularly for domain-level and gender-related comparisons. The coding framework did not capture whether researchers were depicted working

https://doi.org/10.33225/jbse/26.25.870

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

alone or collaboratively, limiting analysis of the "lone researcher" stereotype; future studies should include an explicit solo/collaborative-work indicator.

Declaration of Interest

The authors declare no competing interest.

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Received: *September 03, 2026* Revised: *September 26, 2026* Accepted: *October 12, 2026*

Cite as: Hwang, H., Park, J., Park, E, Chung, D.-H., Koo, J., & Lee, J.-K. (2026). Domain-differentiated researcher representations and future occupational aspirations of science-gifted students. *Journal of Baltic Science Education*, *25*(5), 870–883. https://doi.org/10.33225/jbse/26.25.870

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