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Research Article

FROM AN ELDERLY MIDDLE-AGED MAN TO 'A SCIENTIST MAY BE ANYONE': DAST IN NEPALESE CONTEXT

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Abstract

This paper explores the perception of high school Nepalese students toward scientists using a famous method named as Draw-A-Scientist-Test (DAST). A total of 145 students from Year11 and Year12 took part in this research and drew images of scientists. The findings indicated gender imbalance with male dominance in the images of scientists. The result also showed some usual stereotypes relating to hair, equipment, objects, use of eyeglasses, and lab coat in the drawings of scientists. Moreover, the influence of some mainstream western male scientists was widely seen in the drawings implying the exposure of limited male scientists to the students. In contrast to this, no real-life female scientists were mentioned by the participants demonstrating limited exposure of female scientists contributing to the gendered perception toward the scientists. However, some of the findings also challenged the previous findings and depicted scientists with local features, positive expression, and working outdoors. Moreover, participants' awareness that scientists could be anyone with an inquisitive mind was indicated by the variations in the characters in their drawings. The drawings indicated that scientists could be someone like a mother, themselves, a fashion icon, Buddha, or a crazy-looking person. This study recommends the inclusion of participants' interviews, and exploration of their textbooks' depiction of scientists to uncover additional details regarding their understanding of scientists. Also, a critical discussion of the stereotypical perceptions about scientists in class could help challenge the stereotypical assumptions of scientists.

Keywords: Scientists, Drawings, Stereotypes, Gender, High school students.

INTRODUCTION

Starting from Mead and Metraux (1975) an image of a popular stereotypical scientist was revealed by American high school students in their written response to incomplete sentences regarding scientists. This image was further explored by Chambers (1983) among kindergarten and primary level students through their drawings of scientists and found similar stereotypical images of scientists. According to these researchers, students tend to reveal scientists with specific physical characteristics, gender, and appearance, usually working in indoor labs, and doing experiments. Until now, the Draw-A-Scientist-Test (DAST) has been conducted in multiple countries in various school and college level students to explore their perceptions regarding scientists. The findings are invested by the stereotypical perceptions concerning scientists in both college students and elementary school students' drawings of scientists indicating that stereotypical perceptions toward scientists are not limited to younger children (Thomas *et al.,* 2006). A popular stereotypical scientist image consists of a mostly male, middle aged, or elderly person, working in the lab, wearing an overcoat and eyeglasses, and having facial hairs (Chambers, 1983). DAST is mostly conducted in western countries, however, there are some studies even from the Middle East and in African countries. Until now, studies exploring participants' perception regarding scientists using DAST are not found in the South Asian context. Therefore, it will be interesting to see how South Asian students will draw scientists' images. Representing South Asia, this study is exploring the perceptions of Nepalese high school students studying in Year 11 and Year 12 in the present research. Nepalese science textbooks contain mostly western scientists thus it will be stimulating to see if Nepalese students will include the local human features as scientists. Since there have not been any such tests in the context of Nepal, this research attempts to explore images of scientists as drawn by the Grade 11 and Grade 12 students from science classes to investigate science students' views about the scientists. The main purpose of this research is to explore the Nepalese students' perspectives of scientists through their drawing of scientists. It is expected that this research would contribute to the field of science education and to the science teachers to know the perspectives of students. Though this research is limited to the students studying in Year 11 and 12 in the specific school located in Kathmandu, findings from this study can be useful to compare the other studies around various contexts to see the similarities or the differences of the patterns in students' representations.

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LITERATURE REVIEW

Studies related to Draw-A-Scientist-Test (DAST) can be categorised into three different types. The first type of this study investigates the underlining assumptions of the participants regarding their view on scientists by using the traditional DAST method, the second type of this study critiques the limitation and relevancy of this test, and the third type uses DAST with modification to meet the limitations of this test. The studies that still use DAST as a tool to explore the perceptions regarding scientists by making the participants draw an image of a scientist claim that the stereotypical representation of scientists still dominates (Hayes *et al.,* 2020; Brumovska *et al.,* 2022; Pekdoğan & Bozjun, 2019). However, some of these studies also claim that there is a gradual increment of non-stereotypical representations as well. Most DAST methods are used for the junior level school students to investigate their beliefs regarding scientists expressed in their

drawings (Brown *et al.,* 2004). Among the studies that claim stereotypical perceptions concerning scientists in the drawings, a study in the United Arab Emirates found that children tend to draw their gender as scientists, and they reflected stereotypes like working alone, in a lab, wearing glasses and lab coat, and lab equipment in their drawings (Dickson & McMinn, 2022). The number of female scientists in drawings was only 35% in this research and the researchers claim that there was no depiction of UAE cultural resemblance in the drawings. Similarly, another recent research in Italy also had similar findings with more males as scientists and stereotypical appearances. However, this study claims 30.5% of the non-traditional representation of scientists (Bozzato, Fabris & Longobardi, 2021).Even though the stereotypes regarding scientists were present, a study in Turkey found more females and a more positive representation of scientists by children aged 5-6 years (Pekdoğan & Bozjun, 2019). Another study conducted on Grade 3 to 5 students found a significant decrease in the stereotypical activities represented in the drawings though there was still a gender imbalance in the representation of scientists (Hayes *et al.,* 2020). A study in Africa also found repeated stereotypes such as males wearing eyeglasses and a lab coat surrounded by lab equipment in the participants' drawings (Meyer *et al.,* 2019). A meta-analysis of five-decade DAST in the USA claimsgreater male dominance in scientist images among grownup students although there was a gradual increase in the number of female scientists (Miller *et al.,* 2018).

A few studies on DAST are conducted among college students however they claim that there are not many differences in the depiction of the stereotypes among college or junior school students (Thomas *et al.,* 2006). A study on undergraduates' and graduates' science education students found that there was a reduction in the depiction of stereotypes when DAST was used for self-assessing the stereotypes (Miele, 2014). This study also found that the graduates depicted fewer stereotypes than the undergraduates. Another research exploring DAST in the pre-service science teachers with a slight modification in the test found that one-third of the participants chose to categorise their characters in the images as neuter rather than the male or female scientists, 10% of them did not find appearance as important, and most of them depicted investigative activities in their drawings (Reinisch, 2017). These studies claim that DAST still has relevancy if used with appropriate prompts.

The studies that explore the relevancy of DAST are critical of this method. For example, while western researchers claim that most of the drawings of children represented white males, Walls (2022) denies this claim and criticises DAST studies for not including children from colour backgrounds and making false claims. Similarly, some researchers question the assumption behind this method that claims stereotypical assumptions about scientists may decrease the career choices of the learners as they found that the students depicting more stereotypical images of scientists had more interest in their career as a scientist (Toma *et al.,* 2022). Studies also claim that there is no relation between teachers' teaching methods and the students' stereotypical assumptions about scientists (Finson *et al.,* 2006). Some studies claim that students' drawings of scientists should accompany their talks as students' talks were more realistic regarding their view on scientists than their drawings (Brown *et al.,* 2004).

Acknowledging the critiques of this method, some researchers have modified this test by incorporating interviews, descriptions of scientists along with the images, media intervention, and critical discussion of the findings. For example, research on elementary school children in Ireland included interviews of the children along with their drawings of scientists to mitigate the lack of participants' voices in this research and revealed that various kinds of ,scientists were made by the children (Brumovska *et al.,* 2022). A modification of DAST into DASCT (Draw-A-Science-Comic-Test) found that children's comic stories based on scientists depicted locations, appearances, and activities of scientists in their drawings with more focus on activities (Lamminpää & Vesterinen, 2020). This research also revealed that students' depiction of explosions and failed experiments in activities represented a source of joy and excitement rather than fear. Similarly, a study used DAST with the media intervention and also collected students' responses on how they learned to draw the certain image of scientists. The findings revealed that media intervention did not influence the children's gender stereotypes and both boys and girls claimed that they got the knowledge of scientists from television media (Steinke *et al.,* 2007). Another modification in DAST into DAST-C is proposed by Farland-Smith (2012) for better access to children's drawings of scientists. Reinisch (2017) introduced DAST with additional prompts such as a description of drawings and choosing whether they were drawing male, female, or neuter. Similarly, another modified research on DAST made the participants from White, Asian, and Coloured backgrounds draw multiple professions such as a teacher, a veterinarian, and a scientist (Losh, Wilke, & Pop, 2008). The findings indicated that students tend to depict their sex in the images, they understood the professions, portrayed more tools in the drawings of veterinarians and scientists, girls tended to draw more coloured people, and more images of scientists were unsmiling and unattractive suggesting worse images of scientists among students. An Indirect Draw A Scientist Test was used by Bernard & Dudek (2017) avoided the word scientist to explore whether there will be a difference in the depiction of the stereotypes by the students. Although this study had similar findings to the regular DAST, however, it discovered that students drew scientists working in a group and also drew female scientists. Kelly (2018) interviewed students after she found a stereotypical representation of scientists in the DAST and found that the gender representation of scientists was influenced by the children's exposure to more male scientists as most of the children drawing male scientists accepted that haven't encountered female scientists. Although some stereotypes were constant with the other earlier studies, the stereotypes that only male scientists and scientists working alone were challenged by this research. Cavallo (2007) used DAST to challenge the scientists' stereotypes of the students by conducting a discussion on the stereotypes in their drawings of scientists and discussing real-life scientists from multiple backgrounds.

Overall, the findings from DAST seem interesting as it had uncovered the underlying stereotypical assumption of scientists from the participants belonging to various contexts. This test can be used as a quick tool to measure the perspectives regarding various professions. Although Draw-A-Scientist-Test (DAST) is a popular tool to investigate the perspective of participants regarding scientists, no studies in Nepal have explored this until now. Therefore, this study attempts to investigate the immediate and uninterrupted response from the

students regarding their perception of scientists through their drawings. And by doing this, this study attempts to address the gap in DAST test in the context of Nepal.

Data Collection Procedure

A private college located in the heart of Kathmandu was chosen for data collection purposes. This particular college was chosen because of the familiarity of one of the researchers with similar private institutions in Kathmandu as a science teacher. The researcher was also knowledgeable about the popularity of the college and rich number of students in science classes. Therefore, it was expected that the selected college would be inclusive of students from various backgrounds resulting in rich data. The college was also approachable and convenient as one of the researchers was also based in Kathmandu. Students from high school especially from Year 11 and Year 12 were approached for this study. Before data collection, prior consent was obtained first from the college and then from the parents through the college administration before approaching the students adhering to the research ethics protocols. Data collection was done on 4 November 2022. On that day, students were informed in the class that they were taking part in one of the drawing activities for a research purpose. Keeping in mind that the students might be conscious of the presence of an outsider, their science teacher was used to instruct this task in one of their regular science classes. The instructor gave both oral and written instructions by merely stating, "Draw a Scientist." According to the instructor, the students seemed surprised at first by the instruction as it was an unusual and unexpected topic to draw for them and no one had given them such topic to draw before this research. However, later they were happily contained in the drawing activity. Altogether 145 participants took part in this study. Among them, 66 were males and 75 were females.To maintain the privacy of the students, they were allowed to keep their anonymity and instructed to mention their gender and school level in their drawings.Later it was found that four of them forgot to not mention their gender in their drawings. These four drawings are also included in this research.

METHODOLOGY

The methodology used in this study is developed considering the critics of this method including various methods used by previous DAST tests. Based on the available literature on this study, the images obtained from the participants will be analysed based on these categories.

1. *Locations*: Locations are one of the important categories marked in the drawings of the scientists by the participants (Farland-Smith, 2012). In this study, Locations are categorised into indoor, outdoor, and not specified.
2. *Activities*: Activities (Farland-Smith, 2012) are another important depiction by the participants in the DAST. In this study, activities are categorised into experimenting, standing with objects, and passive categories based on the depictions in the drawings. The activity is further categorised into whether they are carried out independently or in a group.
3. *Appearances*: Appearances are one of the dominant traits often depicted with stereotypes in DAST. In this study, the dominant traits such as gender, presence or absence of eyeglasses, lab coat, Frizzy hairstyle, facial hair, age group (young/old), (Farland-Smith, 2012),emotions (positive and negative) (Losh, Wilke, & Pop, 2008; Lamminpää and Vesterinen, 2020), etc will be considered under this topic. Additionally, within appearances any local influence noted will also be marked.
4. *Tools and objects*: DAST test also revealed that research tools and objects were other important contents in the drawing of scientists. Thus, within these various types of tools, technology (Chambers, 1983; Farland-Smith, 2012) or any other objects in the images will be noted.
5. *Caption:* Captions on the images (Chambers, 1983) were another informative content found in the drawings. In this category, any written captions that describe the image will be analysed in relation to the respective drawing.

Based on the above mentioned five categories the images made by the participants were analysed. At first, the analysis was independently done by two researchers on the five categories stated above. Both researchers took part in a constructive discussion in the conflicting parts before coming to agreement. The results from the analysis are presented in the upcoming sections.

RESULTS

The dominance of unspecified locations

The locations in the drawings were categorised into indoor, outdoor, and unspecified as suggested by the image contents. The location without any indoor or outdoor details was categorised into unspecified location. There were some interesting locations suggested by the images where scientists were working outdoors with the equipment that is usually found in chemistry labs. The findings revealed that most of the participants portrayed characters in unspecified locations followed by outdoor settings and indoor settings respectively. The given table presents the data from both male and female participants regarding locations.

Table 1. Locations in the images

Gender	Indoor	outdoor	unspecified
Male	1	17	43
female	7	19	47

The table shows that after unspecified locations outdoors are the most popular locations portrayed in the images of scientists contrasting the previous findings that claim dominance of indoor settings in the DAST (Finson, Beaver & Cramond, 1995; Bernard & Dudek, 2017).

Figure 1. An image showing outdoor activities with local influence

The present finding also reveals that girls depicted more indoor settings than boys as in Bozzato, Fabris, and Longobardi's study (2021). However, there is not much difference in the depiction of outdoor and unspecified locations across the gender. Another feature of the locations depicted in the images was seen in their representation of the local context. For example, in the context of Nepal, they represented Nepalese dominant geographical and natural contexts such as hills, mountains, sunrise, and rivers. This finding contradicts the previous findings that claim no representation of local contexts in the images (Dickson & McMinn, 2022).

The dominance of passivity in activity depiction

It was found that most of the scientists were passive. Most of them were either standing near the equipment, thinking, or only their head part was depicted without any activities. The second popular portrayal was the ones where scientists had some equipment or objects in their hands. Only 19 scientists were conducting experiments. The lack of actively engaged scientists in activity might also be a result of the lack of drawing capacity of the students. The table presents the activity depiction across the gender.

Table 2. The activity types of the drawings

Gender	Experimenting	With object	passive	group	individual
Male	8	19	42	0	69
Female	11	29	48	5	88

In all activity categories, girls are seen ahead of boys. It can be concluded that girls have focused more on the activity depiction than boys. The result is also influenced because some of the participants especially males have not drawn any humans in their DAST activity.

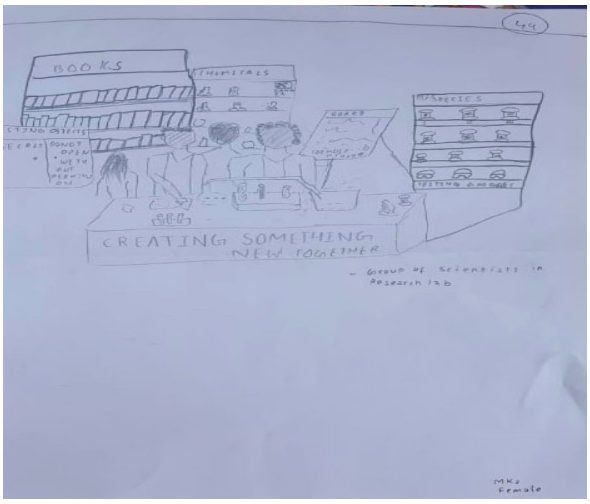

Figure 2. Scientists working in a group

The previous studies also claim the dominance of solitary activities of the scientists in the images produced by the participants (Christidou, Hatzinikita & Samaras, 2012). Some studies also claim that girls drew more images depicting solitary activity (Bozzato, Fabris & Longobardi, 2021). This study also confirms the finding that solitary activity was the most dominant activity represented by the participants however, unlike Bozzato, Fabris & Longobardi's (2021) claim girls rather than boys in this study drew scientists working in a group. The interesting thing is that all five participants in drawing group activities were females.

Scientists' appearances

Appearances are one of the most analysed categories in DAST. There are multiple categories under appearances in this research. All these categories are analysed by past researchers. Appearances in this study include gender, age, as well as presence or absence of eyeglasses, lab coat, crazy hair, facial hair, positive or negative emotions, and any local influence in the appearances. The findings on appearances are presented in various tables and discussed separately. The following table presents the data regarding the gender of the scientists.

Gender

Table 3. Gender of the scientists

Male participants			Female participants		
Male	Female	Neutral	Male	Female	Neutral
52	7	16	51	21	12

The gender representation by the male and female participants was categorised into male, female, and neutral following Reinisch's (2017) modification. From the preliminary observation of the drawings of scientists, it was noticed that students had consciously made some human characters in an androgynous manner indicating scientists can be of any gender.Therefore, the humans who could be both male and the female were categorised into the neutral category. The findings suggested both males and females made all three gender categories although the numbers of male scientists were drawn more by both females and males. However, it can be noticed in the table that the female participants have made more female scientists than male participants mirroring the findings from the previous studies (Steinke *et al.,* 2007; Dickson & McMinn, 2022). Similarly, males have made more neutral images than females in their drawings (Bozzato, Fabris&Longobardi, 2021). The images of scientists asneutral or androgynous characters suggest that the participants were aware that scientists can be of any gender.

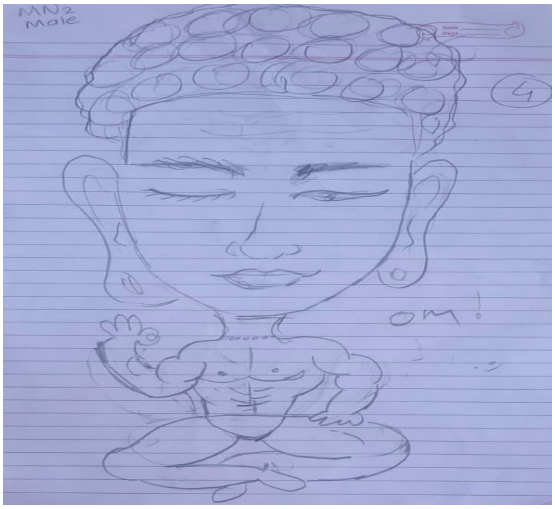

Figure 3. Image of a scientist suggesting local influence: Buddha's head, muscular body, and Om chanting

The appearances of some scientists also represented local influences contrasting the previous findings that claim no local influences in the images (Dickson & McMinn, 2022). The local influences were noticed in the accessories used by women scientists such as tika on their forehead, specific local

clothes worn by the characters, and spiritual figures, and in captions.

Lab safety tools, hair stereotypes and emotions

Table 4. Depiction of lab safety equipment, hair stereotypes, and facial expressions across gender

Gender	Lab safety tools		Stereotypical hair		emotions	
	glasses	coat	face	head	positive	negative
male	16	11	17	23	43	13
female	32	28	10	16	61	8

Both male and female participants have depicted lab safety equipment, hair stereotypes, and positive and negative emotions in their drawings of scientists. However, the lab safety equipment is more drawn by girls confirming the previous findings in other contexts (Bozzato, Fabris & Longobardi, 2021), and hair stereotypes are found more in the boys' images (Steinke *et al.,* 2007; Bozzato, Fabris & Longobardi, 2021). Although positive emotion is emphasised over negative emotions across the gender, females have more positive emotions portrayed in their images than boys (Bozzato, Fabris & Longobardi, 2021).

Age group of scientists

Table 5. The age group and local influence in the images of scientists

Gender	Age group		Local influence
	young	old	
Male	49	9	9
female	67	6	13

Regarding the age of the scientists, the stereotypical age group indicated middle age, or old humans as scientists (Mead & Metraux, 1957; Kelly, 2018). Thus, the age group was categorised into young or old age. The findings revealed that both male and female participants chose the young age group to depict the scientists which is contrary to the findings of Mead & Metraux(1957), but it supports one of the latest findings by Diksons and McMinn (2022). The female participants drew more younger-looking scientists than the males. The number might have been influenced by the total number of female participants that are more than males by 9. Also, more males drewnon-humancontent despite clear instructions.

Tools and objects in the drawings

One of the categories of DAST analysis is the presence of tools and objects in the images. It was found all the participants included some tools and objects in their drawings. The tools included lab glassware, tables, and cupboards used to keep the tools, burner, chemicals, books, objects like rockets, maps and charts, bulbs, and computers. Moreover, there were natural objects such as trees, animals, hills, river, birds, the sun, and the moon to suggest locations. It was noticed that males drew 21 tools and 24 objects in their images of scientists and females drew 44 tools and 51 objects along with their images of scientists. The difference in the number of tools and objects across the gender suggests that girls are more detailed while drawing images than boys. These findings regarding tools and objects match with findings in other contexts where girls made more detailed images with tools and objects than boys (Bozzato, Fabris & Longobardi, 2021).

Captions

Captions were another important content in the drawings of the participants. Most of the participants included captions in their drawings to clarify who the person was, and what was that person thinking or speaking. An almost equal number of boys and girls had captions in their images contradicting the finding from a recent study that claimed boys had more captions (Diksons & McMinn, 2022). Altogether 41 female participants had captions in their images in contrast to 40 males. Even though the students were just told to draw a scientist they purposefully included captions to clarify their meanings.

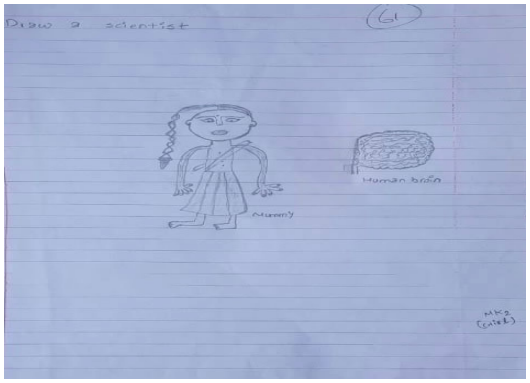

Figure 3. Mother as a scientist with a local appearance

One of the important factors noted in the caption was local influences. Participants had written Nepali words, and names in the captions suggesting the context of the research. The Nepali words were Albert *dai* (means brother Albert), Newton *baba* (means Saint Newton), *para* (means style in slang), etc. The captions also suggested the participants' awareness that scientists could be anyone. Some of the participants had only included the caption 'scientist' in their image suggesting a scientist can be anyone. Also, some captions described who they think scientists are. For example, this participant writes,

"There is not any type of identity of scientist by a diagram. The scientist may be a common man. Look, anyone who invented a new thing even a simple thing, if that is new, those are known as scientists."

One of the participants indicated that scientists might look crazy to the common people however in reality they might be doing a special task. This was demonstrated by a situation in the drawing where two people can be seen doing a side talk about a scientist. One is saying, "He is mad." The other is saying, "Yes, what stupid thing he is doing!" And the scientist is saying, "I would do my job, I won't listen to any nonsense." This conversation denoted the participants' idea of a scientist as an unwavering person who is more focused on his work rather than criticism. Some participants have written mummy under their image of a scientist suggesting their mother is also a scientist. Family relations including mothers were also included as scientists by the participants in other studies (Steinke *et al.,* 2007).

No mention of real-life female scientists

It was noticed that a total of 47 participants out of 145 show influence from real-life scientists in their images. However, no influence is seen from any real-life female scientists in their drawings. Participants rather show influence from the scientists

like Einstein and Newton the most as they repeatedly mentioned their names in the captions. They symbolically included objects related to Einstein and Newton and drew Einstein and Newton-looking characters as scientists. Einstein was characterised by his frizzy hairstyle, thick moustache, and his popular E=MC2 formula whereas Newton was characterised by his long hair, apple trees, apples, and the formula related to Newton's laws. Scientists such as Nicola Telsa, Galileo, and the father of biology were some other scientists mentioned and drawn representing real-life scientists. However, no female scientists were mentioned in the drawings. The repeated mention of Einstein and Newton in the drawingsindicates the influence of these scientists on the participantspotentially due to the students' encounter with these scientists in their textbooks and media. Although this research did not seek information regarding their inspiration to draw the scientists, research by Steinke et al. (2007) claims students get inspirationfrom mediaor some other resources to draw scientists. It could be a result of the minimum encounter of female scientists by the participants as found by Kelly (2018). In the case of Nepal, students' images might have been influenced by both textbooks and media as students are exposed to these resources in their everyday life.Thesefindings also indicate how textbooks and media are biased in overtly representing specific mainstreamwestern male scientists contributing to the invisibility of female scientists.

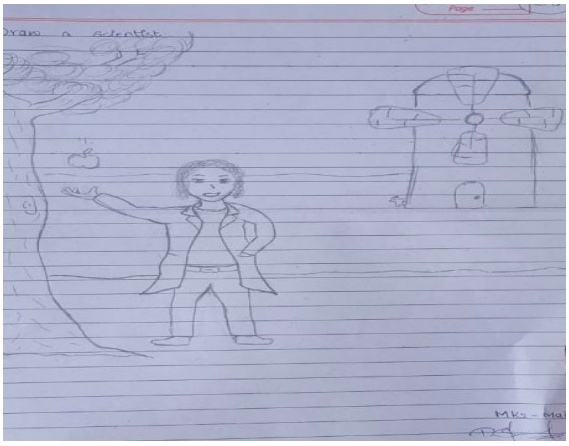

Figure 5. Image suggesting Newton's influence as a scientist

Despite the influence of western male scientists, participants have included names, appearances, and settings depicting Nepalese local people as scientists which is a positive finding in this study.

DISCUSSION

Local influences in the images of scientists

One of the important findings of this research is the local influence on the drawings of scientists. These local influences have come in diverse forms. Some influences are seen in the setting, some are seen in the appearance, and some in the captions. The local influence in the setting is suggested by the natural environment of hilly geography, rivers, and sunshine in the drawings as suggested in Figure 1. The local influence in the appearance is noticed in the Buddha's head as seen in Figure 3 and the accessories worn by the characters such as a tika (a round object worn on the forehead by women) and clothing (sari worn by women) as seen in Figure 3. Besides these, captions also indicate local influence as they represent Nepali words and names such as *dai* (means brother), *para* (means style), *baba* (means saint), words such as *Om,*and names like Lalita. Figure 3 shows one of the strongest local influences and a unique in-depth meaning of a scientist. In this image, a scientist is indicated as a character with the highest spiritual attainment and a strong physical body indicated by the Buddha's head and a muscular body positioned in a lotus posture. The face also represents one eye open, and another eye closed indicating a person knows the inner self as well as the outer world. Moreover, the caption *Om* also indicates the spiritual word popular in Hindu and Buddhist religions which are the first and the second most popular religions in Nepal. This finding challenges the previous findings that claim no local influence in the images of scientists (Diksons & McMinn, 2022). This also suggests that images are far or less influenced by the social contexts of image makers (Rose, 2016).

Images are not the best way of expressing to all

Even if the research was conducted among high school science students, the findings indicated that all participants are not capable of expressing their views through the images. This is indicated by the stick figures, lack of details, absence of human figures, and use of only words in the drawings despite they were clearly instructed to draw an image of a scientist before conducting the activity. Also, there is no difference between the drawing skills of Grade 11 and Grade 12 and the elementary school children in other studies. Moreover, participants used captions voluntarily with their drawings of scientists to complement their expressions and meanings. This indicatesthe insufficiency of a single mode of expression for clear meaning. Additionally, some participants have written just SCIENTIST instead of drawing an image of scientists as seen in Figure 6 below. This indicates drawings might not be an appropriate way of expression for all the participants thus, they should be allowed to express themselves through the mode they feel comfortable with.

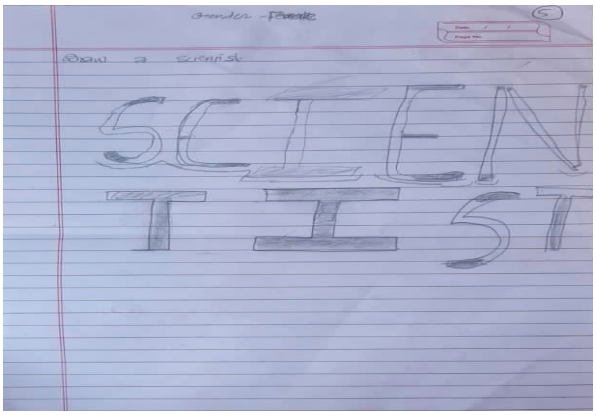

Figure 4. A drawing with only the caption 'scientist'

Influence of mainstream male real-life scientists

It was noticed that both girls and boys were influenced by only a few mainstream male scientists. Newton's influence seemed the highest followed by Einstein. The influence of these scientists was marked in their formula, names, and their physical characteristics. This suggests a serious problem in science education indicating maximum exposure of mainstream male scientists to the participants. This exposure may be potentially through textbooks, other learning materials, and media.

The findings from textbook research in various contexts indicate that textbooks contain limited exposure to females (Blumberg, 2015) including science textbooks and resources (Kahvechi, 2010; Paneru, 2019; Kerkhoven *et al.,* 2016). These studies regard textbooks as an important factor in gender socialisation contributing to gender parity (Blumberg, 2015) and learning outcome (Good, Woodzicka, & Wingfield, 2010). Kelly's (2018) research also uncovered information that the reason behind drawing male scientists was the students' encounters with male scientists. These studies accept that learners are influenced by the repeated encounter of personalities in their textbooks. The findings from the present study also indicate that the participants are seemingly more exposed to Newton and Einstein than any other scientists in their student careers. This is also proved by the images of female scientists made by the participants as none of them represent any real-life scientists. This strongly proposes that thereislimited exposure to female scientists in their textbooks and other learning materials. Therefore, it seems obvious that the participants would not draw female scientists until they are highly critical. However, exploring this area was beyond the scope of this research and thus left for future researchers.

Breaking stereotypes

The findings from this study have broken some stereotypes in DAST unlike previous studies in the depiction of setting, local influence, activities, and positive expression.

One of the contradicting findings of this research is the prevalence of more outdoor settings in the drawings in DAST. Previous researchers of DAST have claimed that indoor setting is one of the stereotypical depictions of the scientist images. However, in this study, it was observed that most of the settings were unidentifiable as the students drew characters on a blank background. As suggested in Table 1, the outdoor setting was one of the most popular settings in the images of both boys and girls in this study. As mentioned in the previous section this research also uncovered local influences in the images of scientists through appearances, activities, settings, and captions. The local influence is seen in the local dress, words used in the captions, and the activities and appearances of the scientists. Among activities, this research found a majority of scientists passive or standing only with some equipment rather than being involved in the actual activities. Besides some images suggest scientists outdoor, in space, and in nature not stereotypically doing something inside a lab. Some of the activities depicted in the drawings such as a scientist in a meditative posture is also non stereotypical and unusual. Another breaking of stereotypes can be found in the expression of scientists in the drawings. The findings regarding expressions revealed that the maximum images of scientists were smiling and with positive expression son their faces rather than unfriendly or angry expressions as in the previous studies (Brumovska *et al.,* 2022; Losh, Wilke, & Pop, 2008).

These all indications in the participants' drawings break the stereotypic image of indoor working, unhappy characters as scientists.

Participants' awareness that scientists can be anyone

Even though as a part of the task students had to draw someone as a scientist, it was noticed that they were aware that scientists could be anyone. This was reflected in their queries and confusion before starting their drawing activity. After the instruction, the students were heard saying, "How can we draw a particular image of a scientist when a scientist can be anyone in various appearances?" This awareness was later suggested by their drawings of scientists from various gender, characteristics, and backgrounds. Moreover, their captions also suggested that scientists could be anyone who invents new things, or scientists could be a family member such as a mother (see Figure 4), or someone who has an inquisitive mind that questions the natural phenomena like Newton, or a spiritual person, or a person with a stronger physique, or a crazy looking person. The images of scientists in multiple forms and characteristics indicated that participants were aware of the multiple possibilities of being a scientist. Moreover, some of the participants even did not want to draw human images as a scientist, instead, they just drew equipment and some of them just wrote the caption 'scientist' instead of a human figure as seen in Figure 6. Although the absence of human character might indicate a lack of drawing skills, this might also indicate participants' awareness that scientists could be anyone.

Conclusion

DAST in the Nepalese context was used as a tool to find the perceptions of high school science students regarding scientists in their natural environment. This research uncovered some unique features as discussed in the discussion and findings section. Some of the findings from this study such as male domination in the scientists' images, use of lab protection such as coats and eyeglasses, and presence of equipment and objects remained the same as in the previous studies. However, there were also some remarkable findings that challenged the previous stereotypes. These findings included the prevalence of outdoor settings than indoor settings in the images, presence of gender neutral characters as scientists, the presence of local influence in the images of scientists, use of only captions and instruments instead of human figures, and presence of participants' awareness of multiple possibilities of scientists. These findings break the continuity of stereotypes in the previous studies. Nevertheless, this study also claims the potential impact of limited western mainstream male scientists on the participants resulting in repeated images of limited scientists such as Einstein and Newton in their drawings although what inspired them to include these scientists was not explored in this research. Therefore, this study recommends DAST method to incorporate interviews and exploration of the student's textbooks and learning materials to ensure their impact on their drawings. Similarly, this study also implied that students were aware that scientists can be any person with an inquisitive mind. As the students were told to draw a scientist, this research assumes that the task itself might have limited their expression of scientists in one image. However, through gender-neutral and androgynous characters, people from their family relations, individuals representing spiritual and physical perfection, omission of humans in drawing, and captions have directed that the students were aware of the multiple possibilities of being a scientist. Since this study only incorporated images, captions, and limited interaction with the students regarding their images, it is anticipated that findings including a detailed interview might bring additional information regarding the students' perception toward the scientists. A critical discussion about the stereotypical images of scientists in various contexts with the students may also impact the images of their scientists.

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