DISSERTATION

A PICTORIAL VERSION OF THE RIASEC SCALES OF THE PERSONAL GLOBE INVENTORY

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY SERENA ENKE ENTITLED A PICTORIAL VERSION OF THE RIASEC SCALES OF THE PERSONAL GLOBE INVENTORY BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

A PICTORIAL VERSION OF THE RIASEC SCALES OF THE PERSONAL GLOBE INVENTORY

Holland's theory of six work personalities has become a staple of vocational psychology, providing a robust and simple model for understanding the structure of vocational interests. Though Holland's types provide a common vocabulary for vocational psychologists working with a variety of populations, until this point there has not been a measure of Holland types that is accessible to vocational clients with reduced reading levels. In an effort to fill this gap in assessment materials, a pictorial Holland-based vocational interest inventory was created by translating the short form of the Personal Globe Inventory (PGI; Tracey, 2002) into images. Each item on the short-form PGI was translated into two line drawings representing a woman and a man engaging in each activity. The pictorial translation was used to assess 290 women and 247 men who also completed the target PGI items in English. Evidence for reliability and validity of the scale scores was assessed; scores on the pictorial translation scales were shown to be internally consistent and stable over two weeks. Scores from the pictorial PGI were also shown to correlate strongly with corresponding scale scores on the verbal PGI. Analyses using Circular Unidimensional Scaling demonstrated that the results from the pictorial instrument fit Holland's circular model of interests as well as his proposed order of scales around the circle. Implications for counseling practice and directions for future research and scale development are explored.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Interests have been a central focus of counseling psychology (and vocational psychology in particular) for over 100 years, arguably since Parsons (1909) formulated his ideas about the importance of the fit between a person's characteristics and the requirements of her or his occupation. In Parsons' three-step method of increasing this fit by "increasing self-knowledge, providing occupational information, and matching self to job" (Savickas & Baker, 2005, p. 25), interests play an important role in all three steps. Though their role in increasing self-knowledge is most obvious, the fact that occupations as well as people can be categorized by interests allows interests to guide the gathering of occupational information and provide one commonly used criterion by which individuals are matched to jobs. In career counseling, vocational interests are assessed more frequently than any other vocational construct (Hansen, 2005).

John L. Holland's Theory of Vocational Types

In vocational psychology's understanding of interests, one theory has clearly stood the test of time: John L. Holland's theory of vocational types. Holland believed that people's personalities influenced their choice of occupations. He first published his theory of personality and work environments in 1959 (Holland, 1959). In the years following, Holland was diligent in using research evidence to refine his theory and guide the development of assessment instruments based on it (Gottfredson, 1999). Through time and much research validation, Holland settled on six "work personalities" which were used to classify people as well as work environments. He maintained that the match between a person's work personality and her or his work environment ("congruence") was a key factor in determining important outcomes such as work satisfaction.

Often referred to by the acronym "RIASEC," Holland's six types are Realistic, Investigative, Artistic, Social, Enterprising and Conventional. (Though Holland's original [1959] theory used different titles, the basics of each type are still relatively consistent with current usage.) Realistic people like working with *things* and tend to be practical and hands-on. Investigative people like working with *ideas* and enjoy analysis and mental problem solving. Artistic people enjoy the creation and appreciation of aesthetically pleasing things. Social people like working with *people* and enjoy helping and guiding others. Enterprising people like persuading others and often gravitate toward leadership and administrative positions. Conventional people like working with *data* and enjoy organizing things.

It was not until 1973 that Holland outlined the roughly circular arrangement of his six work personalities (Gottfredson, 1999). Holland theorized that the six types could be represented using a circumplex model, such that work personalities closer to each other around the circle were more similar and thus more likely to co-occur in the same person or environment (See Figure 1).

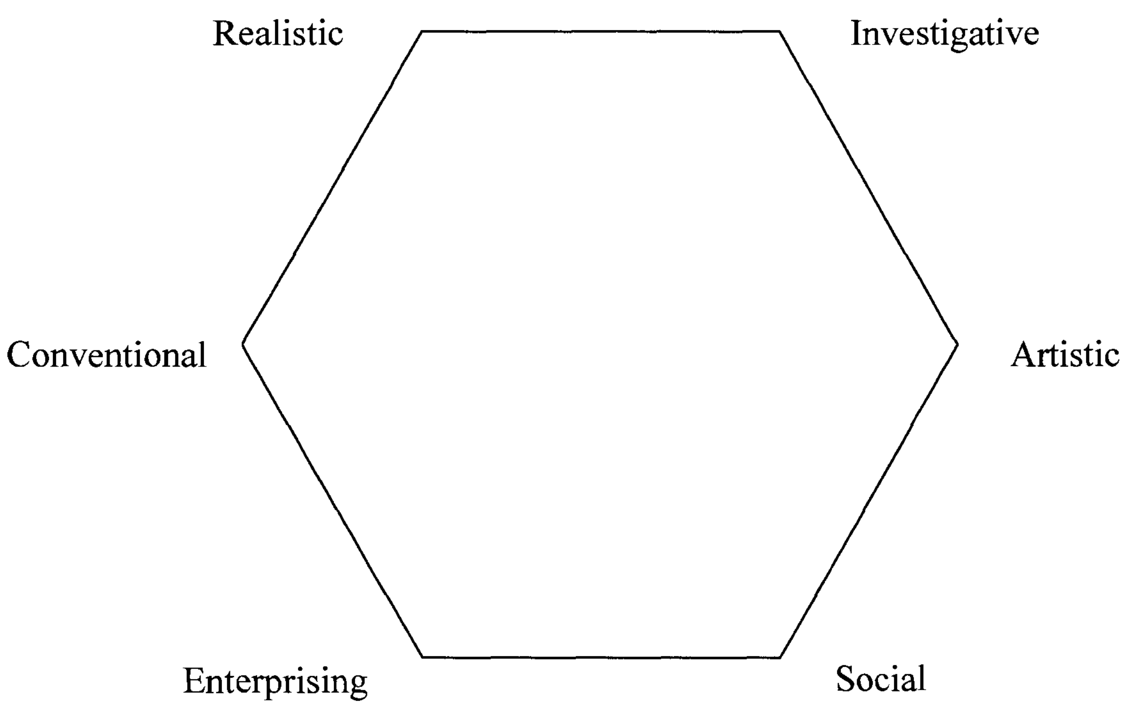

Figure 1. RIASEC Hexagon representing the relationships between Holland's six types. Types which are closer to each other on the hexagon are thought to be more similar and thus more likely to co-occur within a person or occupation.

This structure also meant that work personalities across from each other on the circle were less similar and less likely to co-occur in the same person. A person would be more likely to have strong Realistic and Investigative traits than Realistic and Social, for example. This general structure has been supported numerous times in the research that has built upon Holland's work (e.g. Darcy, 2005; Long, Adams, & Tracey, 2005; Long, Watanabe, & Tracey, 2006; Darcy & Tracey, 2007). This structure is typically evaluated using the Randomized Test of Hypothesized Order Relations (RTHOR) developed by

Hubert and Arabie (1987). RTHOR hypothesizes that relationships between scales next to each other on the circle are stronger than relationships between scales which are further from each other on the circle. RTHOR then analyzes the relationship between each scale and every other scale (a total of 72 relationships) to see whether the pattern fits the expected structure. Hubert has since contributed to a much more parsimonious method of analyzing the circular structure of scales: Circular Unidimensional Scaling (CUS; Armstrong, Hubert, & Rounds, 2003), which was used for the current study. CUS provides more stringent criteria for evaluating the structure of test results than RTHOR. It also has the advantage of providing a single measure of the fit of the results to the model, aiding in interpretation.

Even though Holland's theory is most frequently visually represented using a hexagon, the more "perfect" structure of an equilateral hexagon has not been supported in research. It is worth noting, though, that Holland himself never posited a literal equilateral hexagon and was comfortable with the idea of the structure of interests being a circle (Holland & Gottfredson, 1992). There is some debate as well as to the optimal number of types around the circle. Tracy and Rounds (1995) found that although there is good support for the circular arrangement, different work personalities do not cluster into six nodes around the circle but are rather evenly distributed. This suggests that the division of the circle into six parts may be arbitrary and that other divisions such as Prediger's four (1982; see Figure 2) or Tracey and Rounds' eight (1995) may be similarly effective. The addition of additional types makes RTHOR even more cumbersome, though; eight types increases the number of possible relationships to be individually examined from 72 to 288 (Tracey, 2002). CUS is not constricted by number of types, however, providing a way to assess the circular structure of any number of potential types. However, even given the equivocal evidence for any particular number of types, the use of six types has become "industry standard" due to the ubiquity of Holland's model.

Currently, almost all commercially available interest inventories organize their results in a manner identical or very similar to that proposed in Holland's theory (Campbell & Borgen, 1999), and research using Holland's theory continues to be voluminous and unabating (Savickas & Gottfredson, 1999). It is no surprise, then, that a survey of more than two decades of vocational psychology research determined that milestone publications by Holland are, by an exceedingly large margin, the most frequently cited articles in the field (Borgen, 1991).

Measuring Interests

One of the most prominent interest inventories to incorporate RIASEC was the Strong Vocational Interest Blank (SVIB). The SVIB was first published in 1927, well before Holland developed his theory of vocational choice. In the development of the SVIB, E. K. Strong, Jr., attempted to apply the assessment techniques pioneered by Alfred Binet to interest assessment. That is, he increased the reliability of his instrument's scores by standardizing his questions and increased the validity of his instrument's scores by attempting to link measured interests directly to behavior. Strong also pioneered the empirical method of contrast groups, in which items were selected for a specific scale based on their effectiveness at differentiating satisfied members of an occupation from people in general.

The 1928 manual for the SVIB presents 10 scales which were not organized or clustered according to any particular theory. By 1930, 22 scales were available. These scales represented specific occupations (such as “Engineer,” “Minister,” and “Certified Public Accountant”) rather than work personalities (Campbell, 1971). It wasn’t until 45 years later that the successor of the SVIB integrated the six Holland types in an effort to increase user friendliness. This proved to be a powerful combination of both empirical and theoretical backing that made the SVIB (later, the Strong Interest Inventory) the most widely used inventory of RIASEC interests (Campbell & Borgen, 1999).

Two later expansions of Holland’s theory have attempted to identify dimensions behind Holland’s hexagon. Prediger provided considerable support for two dimensions underlying the circular structure of Holland’s types: people/things and data/ideas (e.g., Prediger, 1982, 1999; Prediger & Swaney, 2004; see Figure 2). Although less commonly referenced and researched, Hogan (Tokar and Fischer, 1998) also theorized two underlying dimensions: sociability and conformity (see Figure 3).

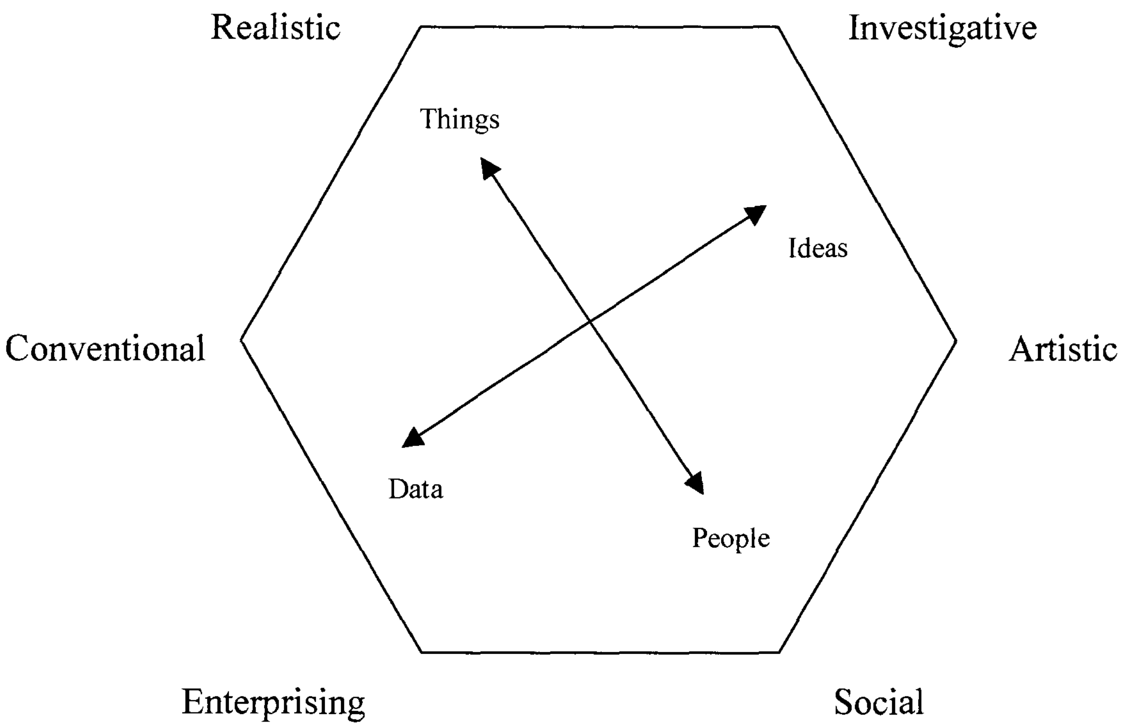

Figure 2. Prediger's two dimensions of People/Things and Data/Ideas. These dimensions are thought to underlie Holland's model, though they can also be used as a simple four-type model of interests.

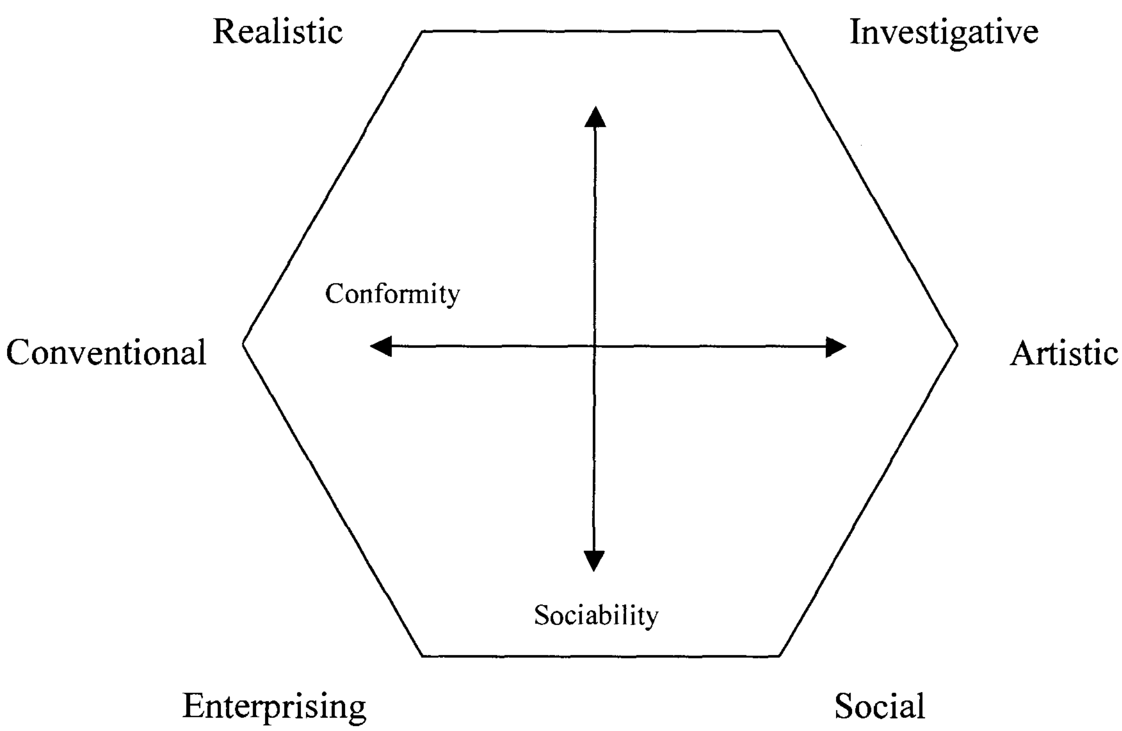

Figure 3. Hogan's two dimensions of Sociability and Conformity.

Later, Tracey and Rounds (1996) began exploring whether a spherical (rather than circular) structure might better represent the interrelationships of vocational interests. Tracey and Rounds' research (1996) showed support for the importance of a third dimension perpendicular to Prediger's two: prestige. In addition to this third dimension, Tracey and Rounds have also advocated the use of eight basic scales rather than six, arguing that "the 6 RIASEC scales are only one of many scale configurations that will fit a circular ordering" (Tracy & Rounds 1995, p. 431). Tracey (2002) used this spherical model with an eight-factor equator (see Figure 4) to form the basis of a new measure of vocational interests called the Personal Globe Inventory (PGI).

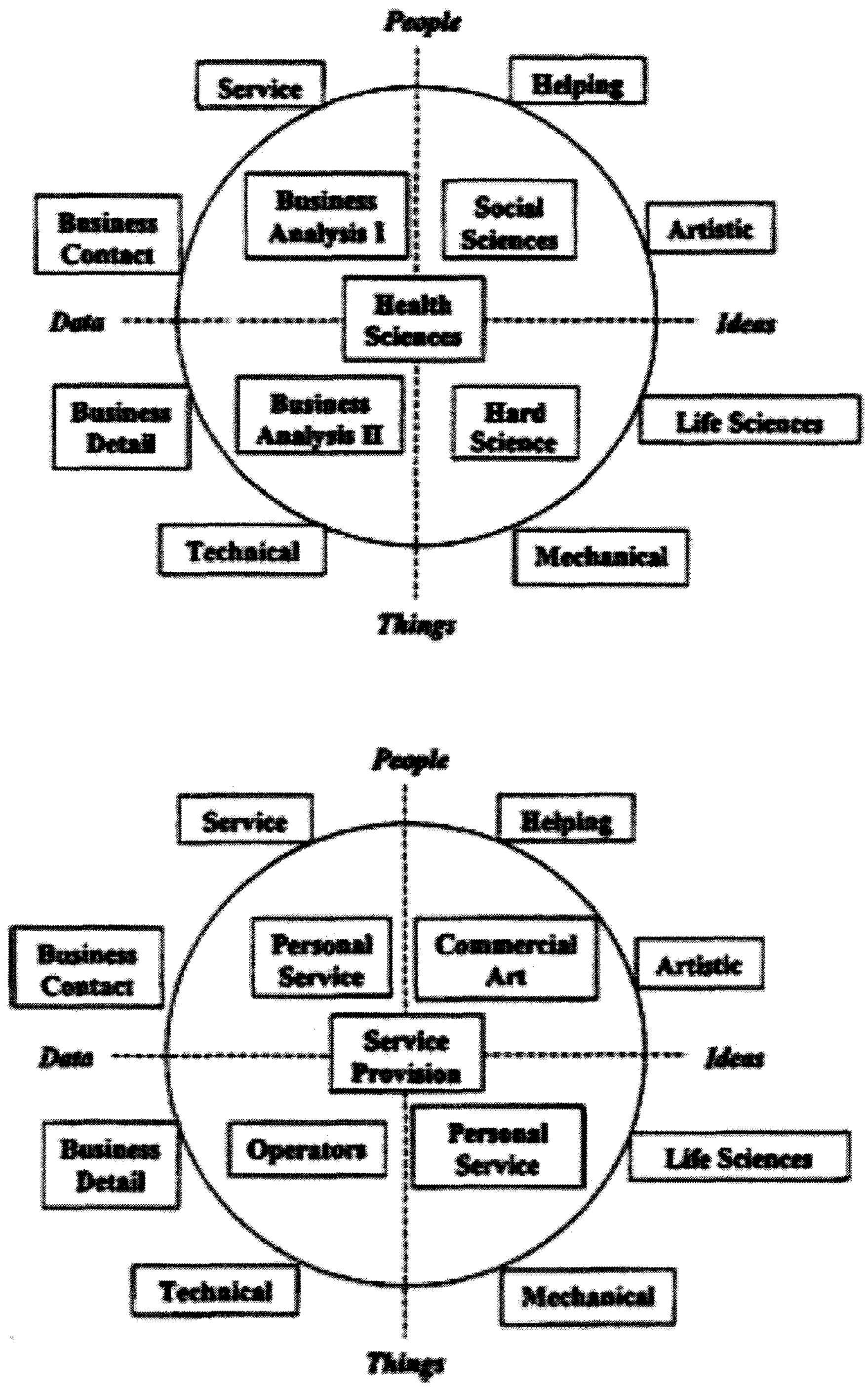

Figure 4. Tracey's spherical model of interests. Around the edge of the circles are Tracey and Rounds (1996) eight scales which form the equator of the sphere. The upper circle depicts the upper part of the sphere with the additional high-prestige scales. The lower circle depicts the bottom of the sphere and the lower prestige scales. (From Tracey [2002], reprinted with permission of the author.)

Although the three-dimensional model fits the data well, the full PGI with all of its various scales can be considerably more complex to interpret than the classic six-factor circular model. The authors of the PGI have been criticized for complicating the elegant simplicity of the traditional RIASEC arrangement (Borgen & Donnay, 1996), but one of the advantages of the PGI is that it still provides the user with the basic RIASEC scales in addition to the fuller spherical model. The shorter version of the PGI which produces the six RIASEC scales is the focus of the current project.

The PGI presents an ideal instrument for translation. First, its scores have been shown to be reliable: internal consistency estimates show the RIASEC scales to be homogenous (all coefficients are higher than $r = .80$) and two-week test-retest reliabilities are all above $r = .77$. The spherical structure was shown to accurately represent data collected using the PGI, and the classic two-dimensional circular structure still held for the RIASEC-only scales, both of which were assessed using the randomization test of hypothesized order relations (Tracey, 2002). The PGI scales providing scores for Holland's six types were compared to the corresponding scales on the Strong Interest Inventory and were found to be strongly correlated (mean $r = .70$). In addition to having strong evidence supporting the reliability and validity of its scores for Holland's types, the PGI is available for use in the public domain. Furthermore, although the instrument is relatively new, it has already been translated and the results from the translated instruments have provided support for cross-cultural validity in Japan (Long et al., 2006) and China (Long et al., 2005). A modified version of the PGI was created for use in Ireland to better reflect local English language conventions and cultural context. This modified instrument was used to support the structural validity of the PGI in Ireland (Darcy, 2005).

Picture Interest Inventories

One of the major weaknesses of all current Holland-based interest inventories is their dependence on a moderate to high level of verbal ability. This makes them inaccessible to a segment of the population that may have difficulty reading for any variety of reasons. One of the first versions of the SVIB, for example, was found to have a reading level comparable to mid- to late-college (Stefflre, 1947). Roeber (1948) pointed out that many interest inventories are commonly used with early high school students but contain vocabulary that is easily misunderstood even by college students. Thus, not only are traditional interest inventories inaccessible to populations with documented difficulty reading, they also may be misinterpreted by "normal" readers. The most recent version of the Strong Interest Inventory is advertised as having instructions with an eighth grade reading level but an overall reading level of ninth grade (Donnay, Morris, Schaubhut, & Thompson, 2005). This makes it relatively accessible to the general population, but still limits its utility for populations with English reading difficulty.

It was in response to this potential ambiguity and restrictive nature of verbal stimuli that led Harold Geist to develop an interest inventory using pictures rather than words: the Geist Picture Interest Inventory (GPII; Geist, 1959). Geist believed that pictures were "closer to real life" (p. 413) than verbal descriptions and would increase the validity of the interest measurement regardless of the reading level of the examinee. The current version of the GPII has some weaknesses that strongly limit its use in vocational assessment today (Vacha-Haase & Enke, 2009). The primary problem is that the GPII is extremely outdated. The last revision was in 1971; many of the occupations and activities depicted in the pictures either no longer exist (e.g., switchboard operator) or are no longer recognizable (e.g., a woman operating an outdated instrument with no clear modern equivalent). The GPII is also organized by Kuder (1956) types, which are not as prominent or as commonly used as Holland types. However, unlike many picture interest inventories which are designed for the mentally retarded population, the GPII presents a range of occupational skill levels from unskilled jobs to those requiring at least a college education.

Several other picture-based inventories exist, and each of them categorizes its occupations differently. Elksnin and Elksnin (1993) reviewed six picture interest inventories determined to be widely used (including the GPII) and evaluated their psychometric properties. They found that the GPII did not report internal consistency reliability. Although Elksnin and Elksnin deem the test-retest reliability of the GPII at six months (males: .60-.66, females: .67-.72) to be "inadequate" because it falls below their suggested cutoff of .80, they do not give any allowance for the fact that the reliability was tested over a relatively long interval (six months as opposed to the typical two weeks). For comparison, its stability estimates are actually comparable to (albeit somewhat lower than) the test-retest reliability of the SII over four years (M = .78 for women, M = .76 for men; Swanson & Hansen, 1988). The GPII does not provide supporting evidence for predictive validity. Also, the GPII was not found to be strongly correlated with Kuder Occupational Interest Scale (males: .16-.62, females: .05-.45), on whose theory the GPII is based.

Elksnin and Elksnin also investigated the Reading-Free Vocational Interest Inventory-Revised (RFVII-R, Becker, 1983). The RFVII-R has 11 scales (Automotive, Building Trades, Clerical, Animal Care, Food Service, Patient Care, Horticulture, Housekeeping, Personal Service, Laundry Service, Materials Handling), but since it is designed specifically for people with mental retardation, only low-skill occupations (e.g., farm worker, janitor) are represented (Becker, 1983). Elksnin and Elksnin reported that the RFVII-R does not provide evidence for internal consistency, content validity, predictive validity, or construct validity. Their test-retest reliability was deemed to be acceptable since most coefficients exceeded .80 at two weeks.

Picture interest inventories fulfill a unique role in vocational assessment because they are accessible to a wider range of people. Historically, they have been used to assess the interests of individuals with mild mental retardation, so some picture interest inventories only portray occupations that do not require a college degree (Elksnin & Elksnin 1993). Now, with increasing numbers of bilingual educational programs and more immigrants with limited familiarity with English but high levels of education from their countries of origin, difficulty reading English does not necessarily exclude someone from achieving an occupation that requires higher education. There are a variety of circumstances other than mental retardation in which a picture inventory may be the most appropriate assessment technique. Pictures would hopefully be less frequently misunderstood by those with reading difficulties due to learning disabilities as well as those with reduced vocabularies due to low academic achievement.

Picture interest inventories can be used for people whose second language is English, especially when good translations of verbal interest inventories are not available in the primary language of the clients. Picture interest inventories are particularly appropriate for deaf clientele whose primary language is ASL. Half of deaf 18-year-olds read at a fourth grade level or below; 80% read below an 8th grade level (Traxler, 2000). In this case it is especially important to use an inventory with a full range of occupation skills as more and more deaf individuals are completing college educations and technological advances continue to make more occupations accessible to the deaf.

The Present Study

The goal of the present study is to develop and establish psychometric evidence in support of female and male pictorial versions of the RIASEC scales on the Personal Globe Inventory. Each activity depicted in the items from the basic RIASEC scales of the PGI was visually depicted in a line drawing. This pictorial version was administered to 290 women and 247 men on two occasions separated by two weeks. At the second administration, participants also took the verbal PGI. Evidence for internal consistency, test-retest reliability and construct validity of the pictorial PGI scores was assessed. Finally, Circular Unidimensional Scaling (CUS; Armstrong et al. 2003) was used to determine the extent to which the data fit the classic circular RIASEC model.

METHOD

Participants

Two hundred and ninety female students (255 White/Non-Hispanic [87.9%], 15 multi-ethnic [5.2%], 11 Hispanic [3.8%], 7 African American [2.4%], and 2 Asian [0.7%]) and 247 male students (201 White/Non-Hispanic [81.4%], 18 Hispanic [7.3%], 10 multi-ethnic [4.0%], 8 Asian [3.2%], 7 African American [2.8%], 2 "other" [0.8%] and 1 American Indian [0.4%]) in Introductory Psychology courses received course credit for participating. The mean age of the participants was 19.16 (SD = 2.87). Participants included 337 freshmen (67.8%), 121 sophomores (22.5%), 53 juniors (9.9%), 15 seniors (2.8%) and 11 students who did not fit into any of the traditional four school years (2.1%). Each participant took the pictorial version on two occasions separated by two weeks. On the second administration, participants also completed the 48 verbal PGI items needed to calculate the RIASEC scales. Participants completed the verbal PGI after both administrations of the pictorial PGI to prevent the verbal PGI from priming participants' understanding of the line drawings.

Instruments

Demographic Questionnaire. During the first administration, participants also completed a demographic questionnaire oriented toward college students. From this questionnaire, information about age, ethnicity, gender, and year in school was used for the current study.

Personal Globe Inventory-Verbal. The Personal Globe Inventory is a 221-item instrument that measures interest and competence for both vocational activities and occupations. It can be used to generate 31 different scales, each of which can be applied to activity preferences, activity competence beliefs, and occupational preferences. A shorter, 48-item version can be used to calculate the traditional six RIASEC scales (Tracy 2002). The short version of the instrument was used for the purpose of this study. Each item in the short form presents a vocational activity such as "Install electrical wiring" (item 5) and "Manage an office" (item 18). The instrument asks examinees to rate each item on a scale from 1 (Strongly Dislike) to 7 (Strongly Like). An examinees score for each scale is then calculated by summing their ratings for each item that contributes to that scale.

The verbal PGI has been shown to be a reliable and valid measure of vocational interests. As reported in Tracey (2002), the verbal PGI is internally consistent: the alphas for the six RIASEC scales range from .81 to .92 (M = .86). It has also been shown to be stable over two weeks with two-week test-retest estimates for the RIASEC scales ranging from .80 to .85 (M = .82). The PGI has also been examined using RTHOR, and its results were shown to match the circular structure and scale order predicted by Holland's theory (Tracy 2002).

Personal Globe Inventory, Pictorial. A 48-item pictorial translation of the PGI, with items using the same 7-point rating scale, also was administered. The translation of the verbal to the pictorial PGI is described below.

Procedure

Translation of verbal to pictorial PGI items. Each of the 48 items required to generate the basic RIASEC scales on the PGI was visually represented in a line drawing by a hired artist. The artist was asked to visually represent each PGI item as clearly and simply as possible, avoiding the use of words in the pictures as much as possible. A panel of individuals composed of three trained undergraduate students, four Counseling Psychology graduate students, and one Counseling psychology faculty member, all familiar with Holland's theory, was solicited to aid in the evaluation of the drawings. Three members of the panel (the faculty member and two graduate students) were familiar with the verbal PGI; all other panel members were unfamiliar with the original PGI items. The panel evaluated each drawing for its clarity and interpretability, and modifications were made accordingly. The pictures were then "back-translated" into verbal form by this same panel. For the back-translation, each panel member viewed each picture and attempted to describe in a short sentence what activity was being performed. Modifications were made to any picture whose verbal translation differed significantly from the original PGI item. Finally, for each item, two versions were created which were identical except for the gendered appearance of the main character performing the action, as gender of the actor has been shown to influence reported interests in the activities, even when examinees are told to ignore the gender of the actors (Tetreau & Trahan, 1988; See Appendix C for pictorial stimuli). The pictorial did not include any labels and were presented without the accompanying verbal PGI items.

Survey administration. All instruments were administered online through surveymonkey.com. Information about the study was posted on a website accessible only to students in Introductory Psychology classes. Participants signed up for the study through this website and received course credit for completing the study. When participants signed up, they were emailed a unique four-digit identification number and a link to the first part of the study. After two weeks, participants were emailed a link to the second part of the study. No identifying information was recorded in surveymonkey to maintain participant privacy; identification numbers were used to link each participant's information from the first and second administration. All procedures were approved by the Institutional Review Board of Colorado State University.

Analyses

Evidence for the internal reliability and test-retest reliability was assessed using coefficient alphas and Time 1-Time 2 correlations. Convergent and discriminant validity were assessed by correlating the pictorial version with the original verbal PGI as well as assessing the relationships among scales within the pictorial PGI. The structural validity of the pictorial translation was examined using Circular Unidimensional Scaling (CUS; Armstrong et al., 2003). The CUS process works to find the circular model that best fits the data, allowing the researcher to evaluate whether the circular model that best fits the data matches the circular model posited by Holland. This model includes both the best-fitting order of scales (RIASEC, as opposed to, for example, RAISCE) and the best-fitting distances between the scales. CUS does this by beginning with a random ordering of the scales, then making minute adjustments to both the order of scales and the spacing between scales gradually improving the fit between the model it is producing and the input data. Unlike RTHOR, which analyzes the relationships between all the scales individually, CUS evaluates the structure of the data as a whole and provides a single measure of fit to indicate how much variance in the input data is accounted for by the model it generates.

RESULTS

Descriptive Statistics

Mean RIASEC raw scores and standard deviations for women and men on both the verbal and the pictorial PGI are presented in Table 1. Raw scores for each scale can range from six to 42.

Table 1: *Mean Raw Scores and Standard Deviations*

		R	*I*	*A*	*S*	*E*	*C*
				M (SD)			
Women	Time 1 pictorial	15.63 (6.21)	24.15 (7.17)	25.92 (7.73)	28.21 (5.91)	21.87 (4.95)	16.96 (6.58)
	Time 2 pictorial	15.57 (6.45)	23.65 (7.34)	25.74 (7.90)	27.96 (6.18)	21.75 (5.04)	16.56 (5.96)
	PGI verbal	13.73 (6.45)	21.97 (8.42)	23.72 (9.68)	28.52 (6.08)	22.52 (5.91)	14.03 (5.65)
Men	Time 1 pictorial	22.62 (6.58)	23.39 (6.27)	23.92 (7.32)	22.62 (5.51)	20.20 (4.10)	20.55 (5.46)
	Time 2 pictorial	22.81 (6.88)	23.20 (6.37)	23.40 (7.04)	22.05 (5.52)	20.12 (4.72)	20.94 (5.67)
	PGI verbal	22.55 (7.35)	22.18 (6.75)	21.86 (8.05)	22.29 (5.91)	20.94 (5.44)	20.01 (6.30)

Reliability

Internal consistency estimates (coefficient alphas) for each of the six RIASEC scales range from .66 to .90 (see Table 2). The majority of the alphas are over .80 (M = .81, SD = .06), suggesting the content of each scale is homogenous. Only one alpha (Men, Time 1, Enterprising) falls bellow Nunnally's (1978) commonly used standard for adequate alphas of .70. Alphas from this administration of the verbal PGI are also provided for comparison. The two-week test-retest reliability estimates are also provided in Table 2 for both women (mean r = .80) and men (mean r = .73). For comparison, mean two-week test-retest reliability for the verbal PGI scores as reported by Tracey (2002) was .82.

Table 2: *Internal consistency and test-retest reliability*

		R	*I*	*A*	*S*	*E*	*C*
		Internal Consistency (alpha)					
Women	Time 1 (pictorial)	.82	.75	.84	.81	.78	.87
	Time 2 (pictorial)	.85	.78	.87	.87	.82	.90
	PGI (verbal)	.88	.85	.92	.85	.86	.91
Men	Time 1 (pictorial)	.81	.70	.82	.82	.66	.84
	Time 2 (pictorial)	.82	.75	.80	.81	.75	.87
	PGI (verbal)	.86	.78	.85	.84	.84	.90
		Test-Retest Correlations (r)					
Women		.74	.80	.85	.84	.78	.79
Men		.75	.77	.79	.72	.65	.70

Validity

To evaluate evidence of convergent and discriminant validity, the verbal PGI RIASEC scales were correlated with the RIASEC scales from the pictorial translation. Correlations for each gender from each administration are presented in Table 3. To demonstrate convergent validity, scores on the scales on the pictorial PGI should correlate most strongly with scores on the matching scales on the verbal PGI. Full correlation tables (see Appendix D) show that the strongest correlation between the verbal and pictorial PGIs are consistently between the matching scales (verbal Realistic with pictorial Realistic, etc). To demonstrate discriminant validity, scales should not correlate strongly (if at all) with scales across the circle. The magnitude of the correlations should decrease with the distance of each type from other types on the circle. For example, the Realistic scale should not have a strong positive correlation with the Social scale—its strongest correlation should be with the scales immediately next to it on the circle, that is, with Investigative and Conventional. This should be the case for the intercorrelations between scales on each instrument, as well as the correlations between scales on two RIASEC instruments such as the pictorial and verbal PGI.

Table 3: *Correlations between verbal PGI and pictorial PGI RIASEC scales*

		R	*I*	*A*	*S*	*E*	*C*	*Mean r*
Women	Time 1	.68	.72	.80	.76	.69	.71	*.73*
	Time 2	.80	.85	.89	.87	.82	.82	*.84*
Men	Time 1	.64	.67	.71	.66	.57	.60	*.64*
	Time 2	.83	.79	.83	.84	.78	.81	*.81*

Within each instrument, the relationship between the six scales (see Tables 4 and 5) matches the pattern that would be expected given Holland’s theory, with few exceptions. This is seen in that the correlation between a scale and the scale next to it on the circle (a first degree relationship) is always higher than the correlation between the first scale and the scale twice removed (a second degree relationship). According to Holland's theory, the second degree relationships should also be stronger than the third degree relationships. Although this is almost always the case with the current data, there are a few exceptions. For both administrations to women, the Social-Conventional correlation (2nd degree) is lower than the Social-Realistic correlation (3rd degree). In the first administration to men, Investigative-Enterprising (3rd degree) were more strongly related than Investigative-Conventional (2nd degree). Two other second-degree relationships were not as strongly related as the third-degree relationships: Social-Conventional and Enterprising-Artistic. The second administration to men also had three second-degree relationships that were not as strong as the third-degree relationship: Realistic-Artistic, Social-Conventional, and Enterprising-Artistic. Thus, out of 144 possible comparisons across the four test administrations (72 between first and second degree scales, and 72 between second and third degree scales) only eight do not match what would be expected given Holland's model.

Table 4: *Intercorrelations between RIASEC Scales on Pictorial and Verbal PGI (Women)*

		R	*I*	*A*	*S*	*E*	*C*
				Time 1 Pictorial PGI			
Women	R	–	0.48	0.24	0.17	0.33	0.63
	I		–	0.42	0.18	0.11	0.39
	A			–	0.36	0.18	0.08
	S				–	0.61	0.13
	E					–	0.49
	C						–
				Time 2 Pictorial PGI			
Women	R	–	0.53	0.23	0.14	0.31	0.62
	I		–	0.44	0.17	0.16	0.45
	A			–	0.41	0.23	0.11
	S				–	0.64	0.11
	E					–	0.47
	C						–
				Verbal PGI			
Women	R	–	0.46	0.17	0.00	0.19	0.65
	I		–	0.44	0.10	0.02	0.34
	A			–	0.35	0.14	0.03
	S				–	0.65	0.00
	E					–	0.31
	C						–

Table 5: *Intercorrelations between RIASEC Scales on Pictorial and Verbal PGI (Men)*

		R	*I*	*A*	*S*	*E*	*C*
				Time 1 Pictorial PGI			
Men	R	–	0.25	0.08	0.01	0.20	0.53
	I		–	0.55	0.40	0.14	0.12
	A			–	0.55	0.15	-0.04
	S				–	0.51	-0.08
	E					–	0.44
	C						–
				Time 2 Pictorial PGI			
Men	R	–	0.34	0.13	0.15	0.36	0.55
	I		–	0.54	0.41	0.22	0.22
	A			–	0.57	0.10	-0.10
	S				–	0.50	0.01
	E					–	0.61
	C						–
				Verbal PGI			
Men	R	–	0.33	0.05	0.18	0.45	0.62
	I		–	0.46	0.37	0.18	0.24
	A			–	0.62	0.18	-0.09
	S				–	0.57	0.08
	E					–	0.62
	C						–

To further investigate structural validity, CUS was used to determine whether the data fit Holland's circular RIASEC model. CUS assumes a circular structure and determines the order of scales and distance between scales that best fits the input data. The model that CUS generates can then be evaluated to see whether it fits the traditional RIASEC model. Each time CUS is used on a given set of data, it begins at a random starting permutation of scale order and distances and adjusts until it cannot improve on the model; it is therefore possible for CUS to arrive at a model that is not the best model but which cannot be improved upon. For this reason, CUS is typically run a large number of times, each time with a different starting permutation (Armstrong et al., 2003). In this study, CUS was run 300 times for each set of data. CUS then determines how well the model fits the actual data; this is expressed in the amount of variance in the data that is accounted for by the model (Variance Accounted For, or VAF). Armstrong et al. (2003), the developers of CUS, have suggested that VAFs above .60 represent good fits to the model.

The best-fitting models for the first administration of the pictorial translation of the PGI are presented graphically in Figures 5 and 6. The results below represent the CUS models found for the first administration of the pictorial PGI. The VAFs are all over .91, suggesting that the models represent excellent fits to the data. All best-fitting models reflect the traditional RIASEC order; when alternate models were found, they differed from the primary model only in distance between scales. These data are consistent with Holland's model and support the effectiveness of the pictorial PGI as a valid instrument for assessing Holland scales and as a valid translation of the verbal PGI.

For women, all 300 random starting points generated the same model for the pictorial PGI (Figure 4; VAF = .94).

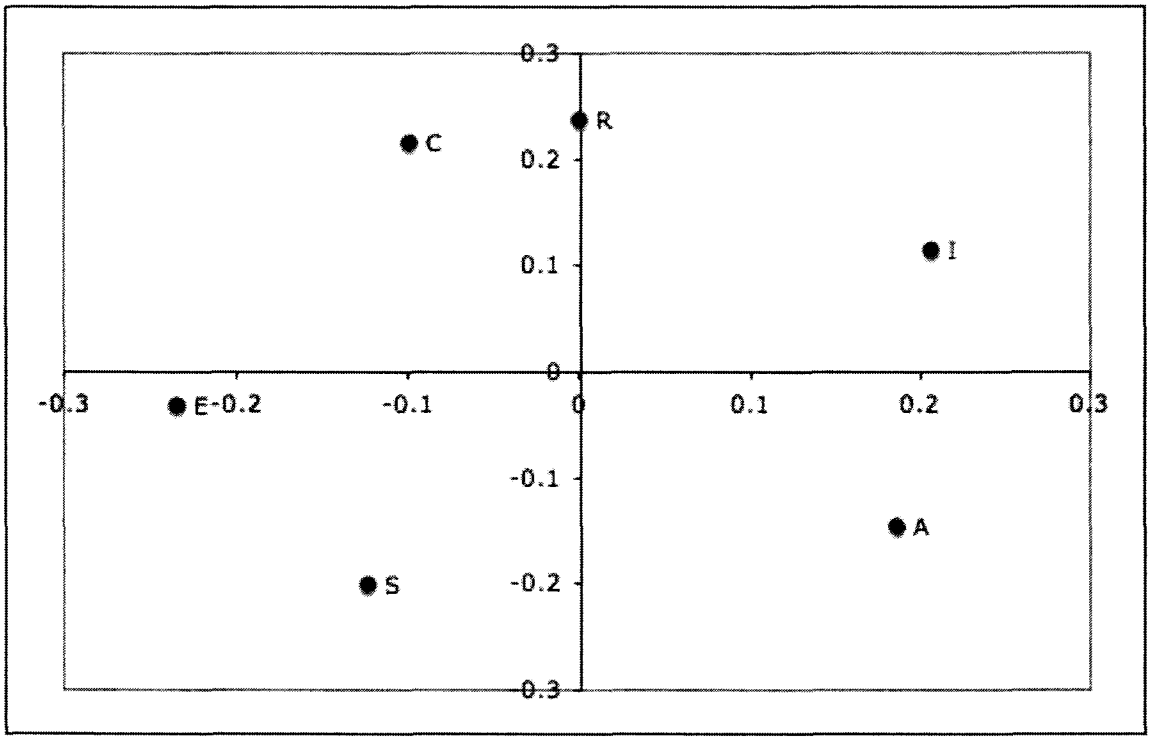

Figure 5. This figure represents the best-fitting model generated by CUS for the female version pictorial PGI. All 300 starting permutations generated this model.

For men, 233 permutations generated a model with a VAF of .93 (Figure 5), 55 permutations generated a model with a VAF of .92, and 12 permutations generated a model with a VAF of .91.

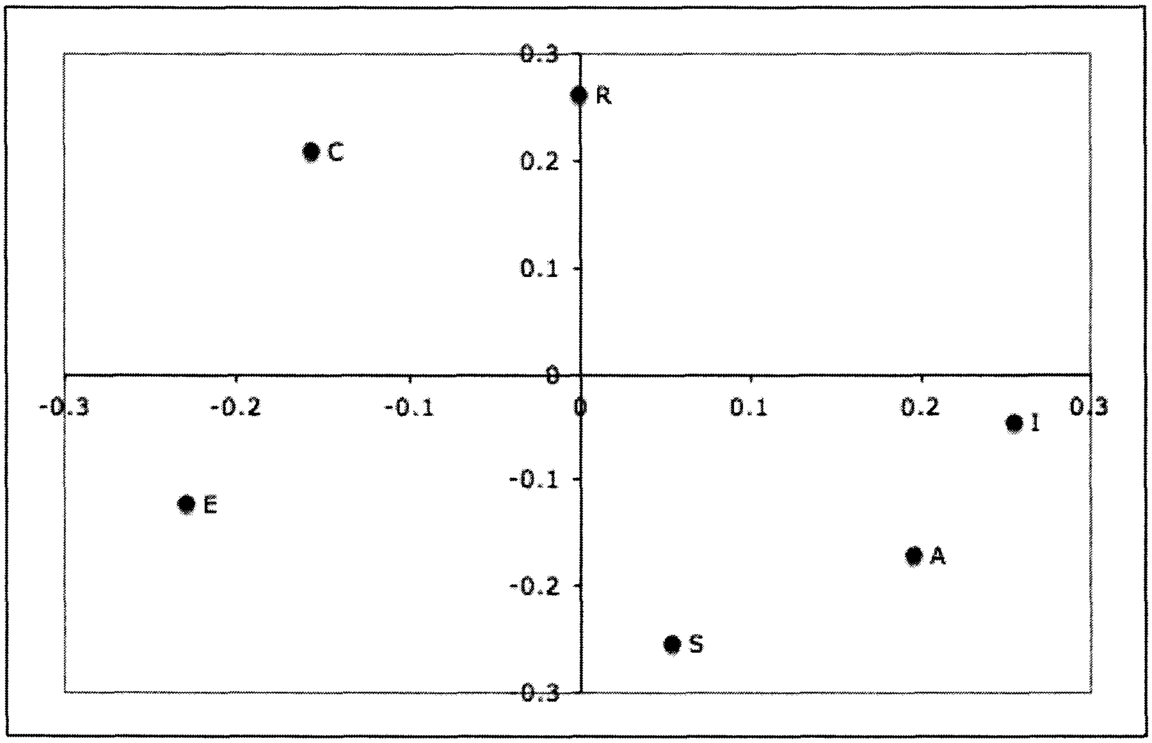

Figure 6. This figure represents the best-fitting model generated by CUS for the male version pictorial PGI. This model was generated by 233 of 300 starting permutations.

For comparison, CUS was also performed on the data obtained from the administration of the verbal PGI. For women, 175 permutations generated a model with a VAF of .95 (Figure 7), and 125 permutations generated a slightly different model, also with a VAF of .95.

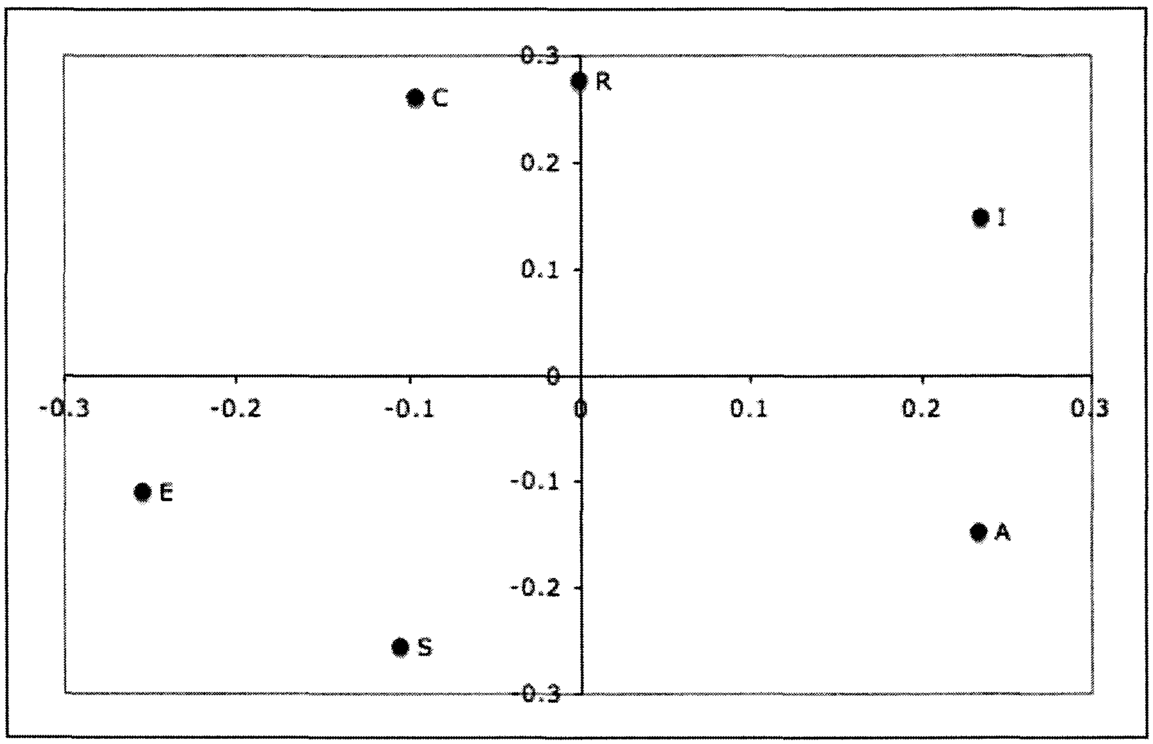

Figure 7. This figure represents the best-fitting model generated by CUS for the verbal PGI administered to women. This model was generated by 175 of 300 starting permutations.

For men, 215 permutations generated a model with a VAF of .88 (Figure 8), and 85 permutations generated a model with a VAF of .87.

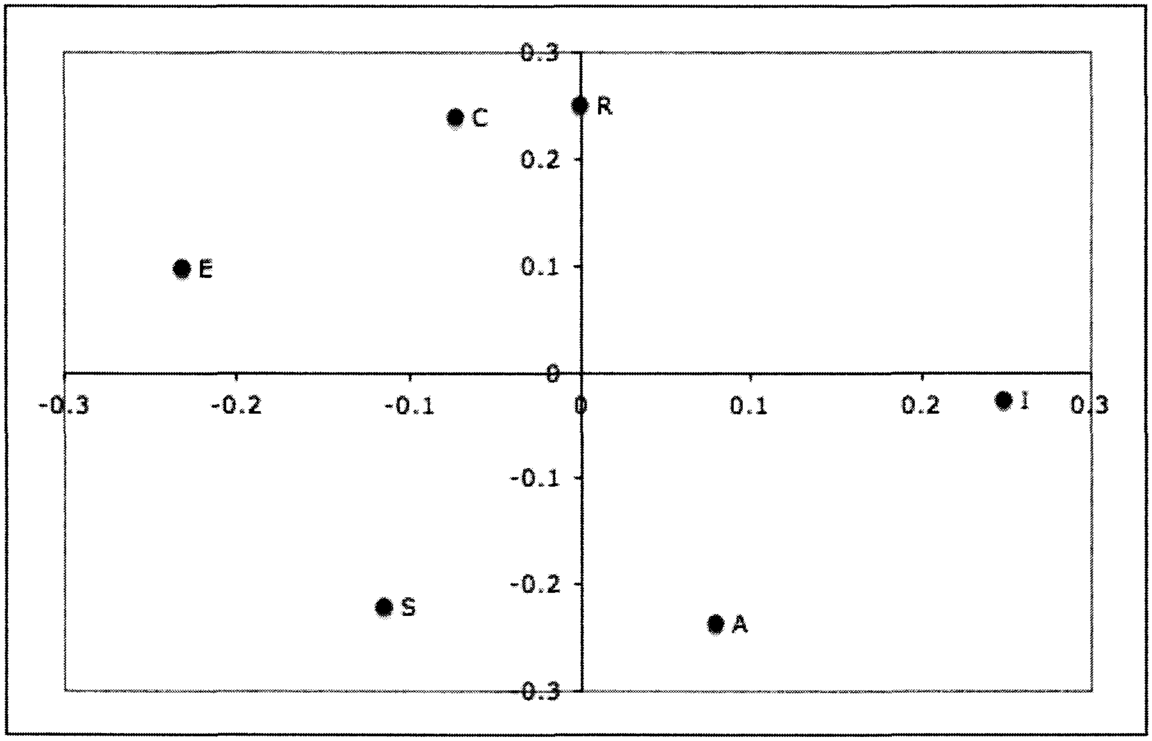

Figure 8. This figure represents the best-fitting model generated by CUS for the verbal PGI administered to men. This model was generated by 215 of 300 starting permutations.

DISCUSSION

Purpose

The goal of this project was to develop, and establish psychometric evidence for, a pictorial translation of the six RIASEC scales on the Personal Globe Inventory (PGI; Tracey, 2002). After the pictorial translation was constructed, the specific questions examined in this study were as follows. First, does the pictorial translation of the PGI provide reliable scale scores? Second, how well do the pictorial PGI scores correlate with the original (verbal) PGI? Third, how well do the pictorial PGI results fit the hypothesized circular structure and RIASEC order?

This study presents a unique contribution to the field of vocational psychology. There currently is a paucity of pictorial vocational interest inventories that display a full range of occupations and are based on a theory as common and steadily researched as that of Holland. The pictorial PGI provides separate female and male items that depict a wide range of professional and non-professional activities in the world of work, and is used to generate scores on each of Holland's six vocational types. A strength of the pictorial PGI is that it is based on an instrument with strong psychometric support: Tracey's (2002) Personal Globe Inventory.

Another unique contribution of this study lies in the use of Circular Unidimensional Scaling to investigate structural validity. CUS, although new, has been shown to be a powerful, yet parsimonious method of evaluating the circular structure of vocational interests. Though CUS has been used on archival data (Armstrong et al., 2003), until now it has not been used on the verbal PGI.

Summary of Method and Results

The 48 items that are used to generate the RIASEC scales on the PGI were translated into line drawings to create two pictorial versions depicting people performing the vocational activities: a male version and a female version. The pictorial versions were administered to a large group of individuals on two occasions separated by two weeks. On the second occasion, the participants also completed the 48 verbal PGI RIASEC items.

The reliability estimates for the pictorial PGI are generally strong. The mean internal reliability estimate for each of the RIASEC scales across both administrations for both genders ranges between .66 and .90 (M = .81), which is in a range that suggests that the scales are homogenous but not filled with redundant items (John & Benet-Martinez, 2000). The test-retest estimates demonstrate adequate stability over a two-week period. The test-retest reliability is comparable to (though slightly lower than) the two-week test-retest reliability found for the verbal PGI (Tracey, 2002) as well as both the Strong Interest Inventory and the Campbell Interest and Skill Survey (Sullivan & Hansen, 2004) over intervals ranging from three months to three years. This may be due to the use of a college student sample, however. Sullivan and Hansen (2004) found that college student test-retest reliability (.68) was lower than non-student adult test-retest reliability (.82). In comparison to their college student sample, the test-retest reliability of this administration of the pictorial PGI is in the expected range.

Scores on the pictorial PGI correlate well with scores on the original verbal PGI, particularly on the second administration of the pictorial PGI, which was given on the same day as the verbal PGI. The correlations between the pictorial and verbal PGI are as high or higher than the correlations between the verbal PGI and the Strong Interest Inventory reported by Tracey (2002). This supports the idea that the pictorial PGI is tapping into the same constructs as the verbal PGI, giving the results from the pictorial PGI convergent validity.

The structural validity of the results was analyzed by investigating the correlations between scales to see whether scales which are closer on the circle do indeed correlate more strongly than do scale pairings which are further apart on the circle. In almost all cases, the pattern of correlations matches that which would be predicted given Holland's theory. Discriminant validity is also supported by the fact that scales which are across the circle from each correlate only slightly, if at all.

Circular Unidimensional Scaling (CUS) was used to investigate the structural validity of the pictorial PGI. CUS provided a robust and efficient method of evaluating the circular structure of the data. The CUS results for the pictorial PGI match what was predicted based on Holland's theory: all the circles are very strong fits with VAFs well above the criterion of .60 suggested by Armstrong et al. (2003). All best-fit models represent the traditional scale order (RIASEC). The scales are not evenly spaced around the circle, but this is consistent with prior research on the Holland scales as well (Holland & Gottfredson, 1992). The use of CUS is still relatively rare in interest research, but given the strength of the technique and its many advantages over RTHOR, it is likely to become increasingly commonplace in the investigation of the circular structure of interests.

Limitations

One limitation of the current administration of the pictorial PGI is that the populations of ethnic minorities were not large enough to analyze whether the traditional RIASEC structure holds true for a variety of different ethnic groups. Using CUS on a verbal measure (the Strong Interest Inventory), Armstrong et al. (2003) found that for many populations (all groups tested other than White Non-Hispanic and Hispanic American men), a number of best-fit models produced by CUS did not match the traditional RIASEC order. It is possible that the addition of a visual element may cause people to rate an occupation lower if the actor in the drawing does not look like them, as was shown to be the case with gender (Tetreau & Trahan, 1988). However, given the stability of the structure of interests across diverse racial and ethnic groups demonstrated in Day and Rounds (1998) and Day, Rounds, and Swaney (1998), one might reasonably expect the same stability of structure across ethnic groups even in a pictorial instrument.

Several other characteristics of the sample that participated in the current study warrant tentativeness in interpreting and generalizing results. The use of college students may have led to lower reliability estimates (Sullivan & Hansen, 2004). College students also are typically at the beginnings of their careers; many may not have settled on a major, and likely may not be representative of an older population. It would also be valuable to administer the instrument to a population that is actively seeking career counseling.

A few of the line drawings do contain some English words. It will be important to investigate whether these pictures are still interpreted properly by populations who may not be able to make use of the additional cues provided by the words.

It is possible that some of the pictorial items may not have been interpreted as the exact same activity as the verbal item. This is, however, one of the advantages of an instrument that focuses on types of activities rather than specific occupations. Even if an item is not interpreted in the exact same way as the original verbal item, it is likely to at least fall into the same Holland category and thus still provide comparable information for interpretation by clinicians. The high correlations between the verbal and pictorial PGI suggest that a majority of items were interpreted comparably by the participants.

Although the ordering of scales around the circle has been shown to be consistent across genders as it was in the current study (Day & Rounds, 1998), women and men do show differing patterns of responses on Holland-based measures (Hansen, Collins, Swanson, & Fouad, 1993). Hansen et al. (1993) found that with women, Realistic and Investigative scales were not well differentiated and were thus located very close to each other on the two-dimensional plane. This was not at all the case in the current study, which found the Realistic and Investigative scales to be quite far from each other for both men and women. Consistent with Hansen et al. (1993), though, the women in this study did rate Social activities most highly and had lower ratings for Realistic activities. However, their ratings of Conventional activities were also low, comparable to the Realistic activities, which would not be predicted given Hansen et al.'s data. In Hansen et al., women were thought to rate Investigative activities lower because of having relatively little experience with them. In the current study, however, Investigative activities were rated highly. This may reflect the shifting experiences of women in the modern world, particularly college-educated women who no longer view Investigative activities as "men's work."

It would be worthwhile to investigate whether the findings of Tetreau and Trahan (1988) that boys and girls rate occupations lower if viewing an opposite-gender actor in the picture still hold, now over 20 years later. The pictorial PGI provides an ideal instrument for this investigation, as an opposite-gender administration can be compared with the more neutral verbal PGI as well as with a same-gender administration.

Another limitation of the current study is the lack of predictive validity evidence. A longer-term study would enable researchers to investigate whether a person's scores on the pictorial PGI are able to predict future career choices or satisfaction in careers. This lack of predictive validity was also a limitation of the original PGI (Tracey, 2002); given the high level of correlation between the pictorial PGI and the verbal PGI, the results of longer-term studies with the verbal PGI might reasonably be expected to predict similar results with the pictorial PGI.

Future Directions

The next step in the validation of the pictorial PGI involves using the instrument with populations whose English reading comprehension would make the use of the typical verbal inventories questionable. This would include individuals for whom English is not their first language (including native-signing deaf individuals), individuals with reading disorder, and individuals with developmental disabilities. It would be clinically useful to develop norms for populations with various disabilities. Currently, very few norms are available for these populations (Elksnin and Elksnin, 1993), and it would be interesting to explore whether the structure of interests in these groups is significantly different from the more "typical" vocational client population.

It would also be worthwhile to investigate the reliability and validity of scores from the pictorial PGI for use with children. Although simplified versions of adult vocational interest inventories have been used with children (Lesnik & Barclay, 1968; cited in Edwards, Nafziger, & Holland, 1974), the pictorial nature of this translation of the PGI may allow it to be used unmodified for a full range of ages, including children who would not normally have the reading skill to interpret a traditional inventory. The pictorial PGI thus provides a unique opportunity to evaluate the development of career interests throughout childhood, adolescence, and adulthood. Because it can be used with both children and adults, researchers could use the same instrument throughout a longitudinal study rather than modifying and instrument or using an instrument designed exclusively for children such as the Inventory of Children's Activities (Tracey & Ward, 1998).

Another potential avenue of research that would broaden the applicability of the pictorial PGI might include the use of the pictorial PGI to investigate perceptions of competence, rather than just interest. The ability to use the pictorial PGI as a measure of perceived competence as well as interest could expand its clinical utility, especially for the disabled population for whom perceived competence may be a barrier to broad career exploration.

A future direction for the pictorial PGI would involve expanding the pictorial translation to include all the items in the full PGI, rather than just the 48 items used to generate the RIASEC scales. This way the pictorial translation could be used to evaluate occupations as well as activities, and it could also generate the full spherical model of interests and the eight-factor model as developed by Tracy and Rounds (1996).

Implications for Counseling Practice

Though the pictorial PGI can be used with both reading and non-reading populations, vocational counselors should particularly consider using the instrument with populations for whom a traditional verbal interest inventory would be inappropriate or invalid. The results from an administration of the pictorial PGI can be interpreted as any other RIASEC inventory, so clinicians familiar with Holland's theory should be well-prepared to incorporate the instrument into their assessment battery.

The pictorial PGI could be used to evaluate the vocational interests of individuals with mental retardation who are working on entering the workforce. Counselors working in vocational rehabilitation may also find the pictorial PGI useful for clientele who have lower educational levels and may also have lower reading levels. Because the instrument focuses on work personality rather than specific occupations, there need not be a concern about clients identifying interests that are "out of reach" due to deficits in skills or education.

The pictorial PGI should also be considered as an alternative for clients whose first language is not English and no appropriate translation is available. The pictorial PGI may also be the most appropriate instrument to evaluate the interests of native-signing Deaf individuals. However, clinicians should consider that a typical pattern of responses for a Deaf individual immersed in Deaf culture may be different than the typical pattern of responses for individuals more immersed in majority culture. Development of Deaf norms for the pictorial PGI will help to ameliorate this potential problem.

Conclusions

The goal of this study was to develop and validate a pictorial translation of an established Holland-based vocational interest inventory. The PGI has proved to be a robust instrument that has held up well to translation, including the current pictorial translation. Hopefully, this pictorial version of the PGI will prove to be both valid and useful for the variety of populations for whom a verbal inventory may be inappropriate, and will provide a tool for the vocational counselors who work with those populations.

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APPENDIX A: Cover Letter

Work Activities in Pictures - Human Subjects#: 08-171H.

You are invited to be in a research study that will contribute to the development of a pictorial test of work interests. We ask that you read this form and ask any questions you may have before agreeing to be in the study. This study is being conducted by Dr. Bryan Dik, a faculty member, and Serena Enke, a graduate student, in the Department of Psychology at Colorado State University.

There are TWO PARTS to this study. YOU WILL NEED TO COMPLETE BOTH PART 1 (TODAY) AND PART 2 (IN TWO WEEKS) IN ORDER TO RECEIVE CREDIT FOR THIS STUDY. You will receive an email in two weeks with a link to the second part of the study.

Background Information: The purpose of this study is to develop a test of work interests that's picture-based. Eventually, this test will be used to better understand the work interests of people who, for whatever reason, don't read well.

Procedures: If you agree to be in this study, we will ask you to do the following things: We will ask you to check the box below to indicate that you understand and agree with the information provided in this consent form. If you decide to participate in this study, you will be taken to Part 1 of this study, where you will rate your level of interest in the activities portrayed in a series of pictures and answer other questions about your career development, values, and emotions. In two weeks, you will need to return to take Part 2, in which you'll answer the questions about the pictures again, then answer another set of questions about your interests in various career activities. Each part will take about 15 minutes. At all times you are encouraged to contact the researchers with any questions you have about the study.

Risks and Benefits of Being in the Study: The study has minimal risks. First, some of the items may ask about topics that are sensitive to you. In order to minimize this risk, you are encouraged to skip any items you find to be sensitive or which cause you any distress. It is not possible to identify all potential risks in an experimental procedure, but the researcher(s) have taken reasonable safeguards to minimize any known and potential, but unknown, risks. There are no direct benefits to you for participating. However, it is hoped that this study will offer benefits to society as a whole by making career interest tests accessible to a wider range of people.

Compensation: You will receive .5 PY100 research points for your complete participation in this project. The researcher will use your study ID to give you credit after you complete the second part of the study. You must fully complete both Parts 1 and 2 of the survey to receive any research points for this study.

Confidentiality: The records of this study will be kept private. In any sort of report we might publish, we will not include any information that will make it possible to identify a participant. Do not put your name anywhere on the survey.

Voluntary Nature of the Study: Your participation in this study is entirely voluntary. Your decision whether or not to participate will not affect your current or future relations with the University. If you decide to participate, you are free to withdraw at any time without affecting those relationships. Additionally, should you choose to withdraw, you will not receive any penalty against your research participation requirement (i.e., it will not count as a no-show). However, in accordance with the PY100 research policy, you will not receive participation credit for this study. If at any point you feel that you would like to withdraw from the study, you are responsible for contacting the researchers with your name and University identification number so they can assure that your withdrawal is documented and no penalties are administered.

Contacts and Questions: The researchers conducting this study are Dr. Bryan Dik and Serena Enke. If you have any questions, you may contact Dr. Dik at bryan.dik@colostate.edu, or (970) 491-3235. Serena Enke may be contacted at serena.enke@gmail.com. You may also contact the Research Integrity and Compliance Review Office (RICRO) at Colorado State University, Janell Barker, Human Research Administrator, (970) 491-1655.

You may print this form to keep for your records.

DO NOT PUT YOUR NAME ON ANY PART OF THE ONLINE SURVEY.

An answer to one of these two choices is required to go on

You must click on one of the following options to continue:

- I understand the terms of this consent form and consent to participate. Take me to the next part of this survey.
- I do not feel comfortable giving my consent at this time. Exit me from this survey.

APPENDIX B: Debriefing Form

Thank you for participating in our research!

This study contains no elements of deception. The purpose of this study is to develop a picture-based interest inventory so that people who have difficulty reading English for whatever reason can have a more accessible test of work interests. Before this test can be given to people who have difficulty reading, we needed to give it to people without particular difficulties in reading along with a more traditional measure of vocational interests so we can determine if the pictorial test is measuring the same thing.

For more information on how Psychology interacts with the world of work, see module 37 of the current Psychology book by David Myers.

We don't expect that any of the activities you participated in will cause you any distress or harm, but if you feel that they have, or if you want your test results removed from the study for whatever reason, please contact the project coordinator listed below.

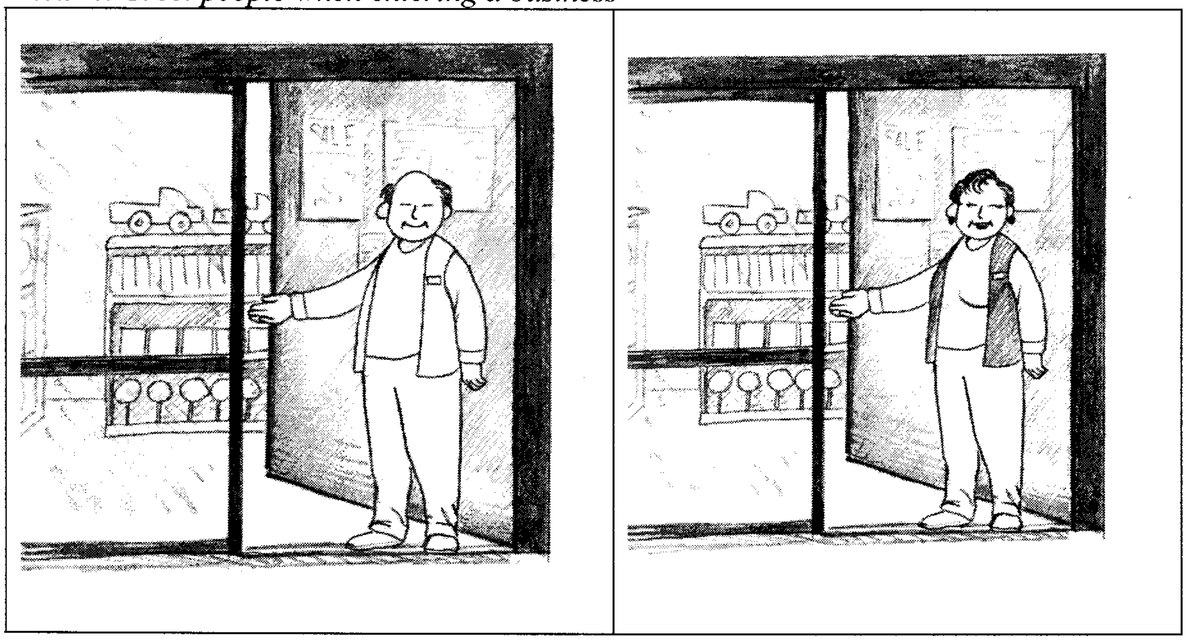
Serena Enke
(970)491-3788
serena.enke@colostate.edu

Bryan Dik, Ph.D.
Bryan.Dik@colostate.edu
(970) 491-3235

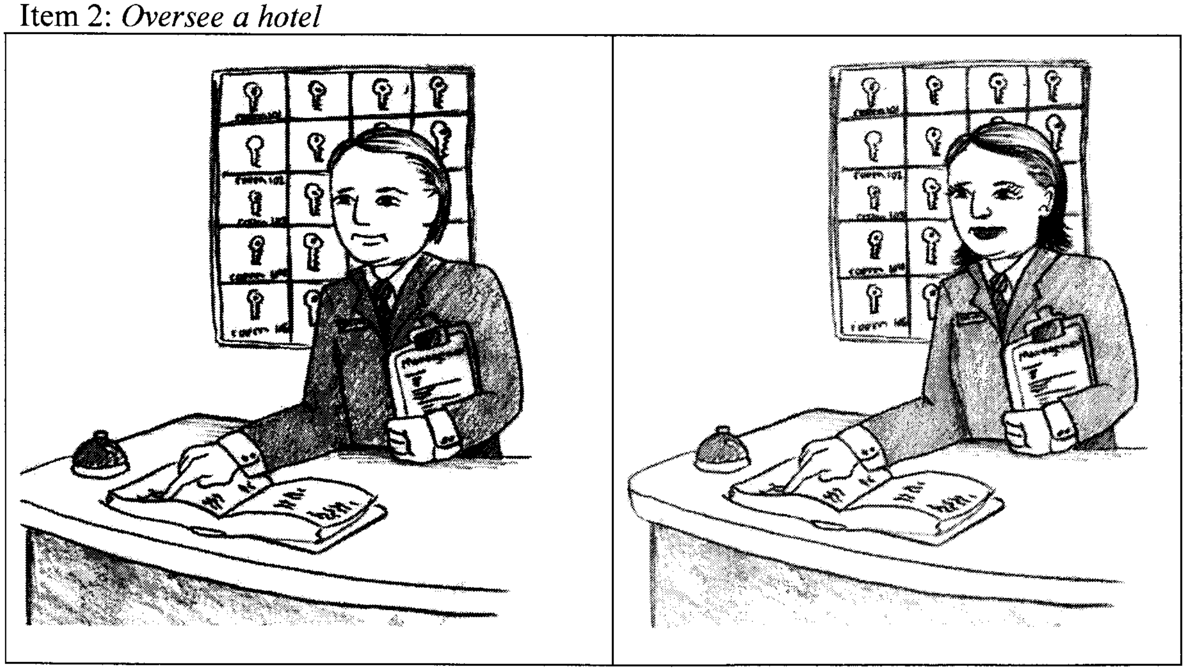
Thank you for your help in this research. We appreciate your willingness to share your opinions and information with us!

APPENDIX C: Pictorial Translation of the PGI Items

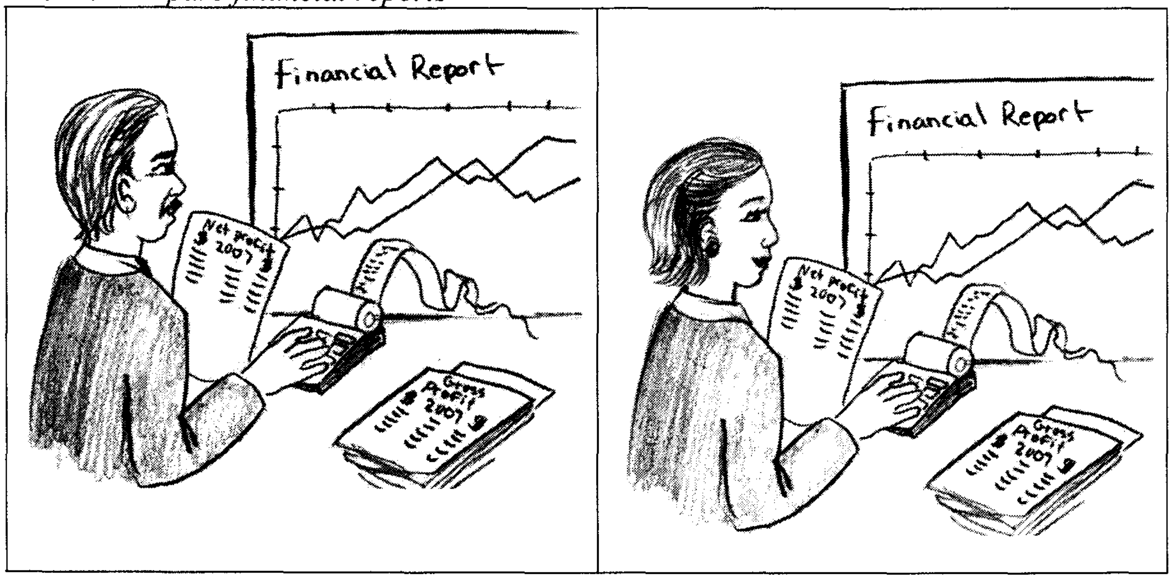
Item 1: *Greet people when entering a business*



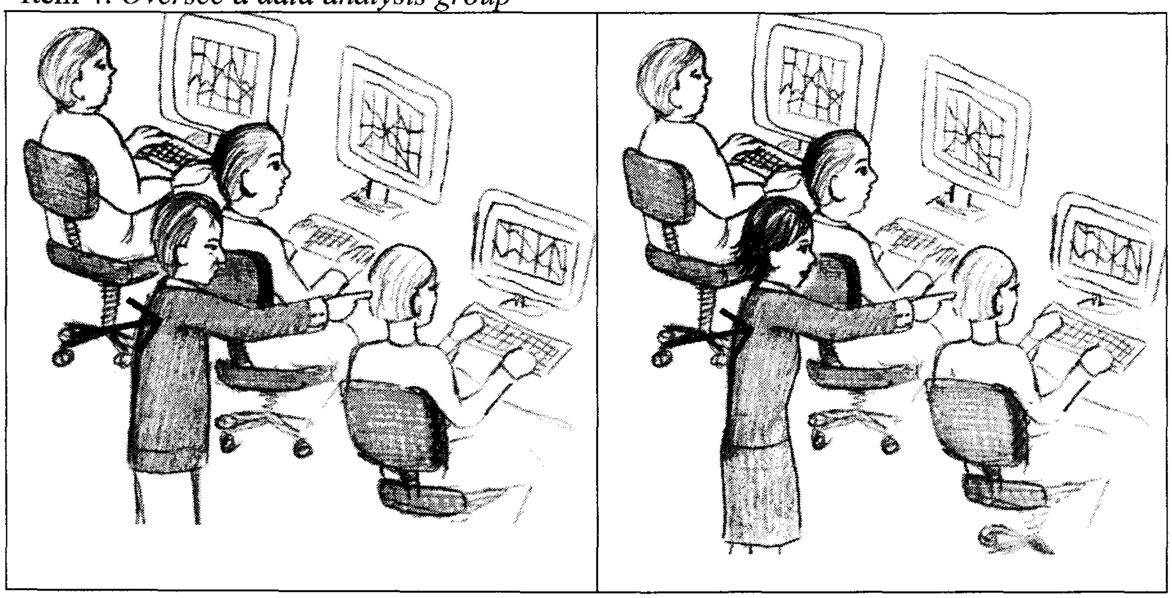
Item 2: *Oversee a hotel*



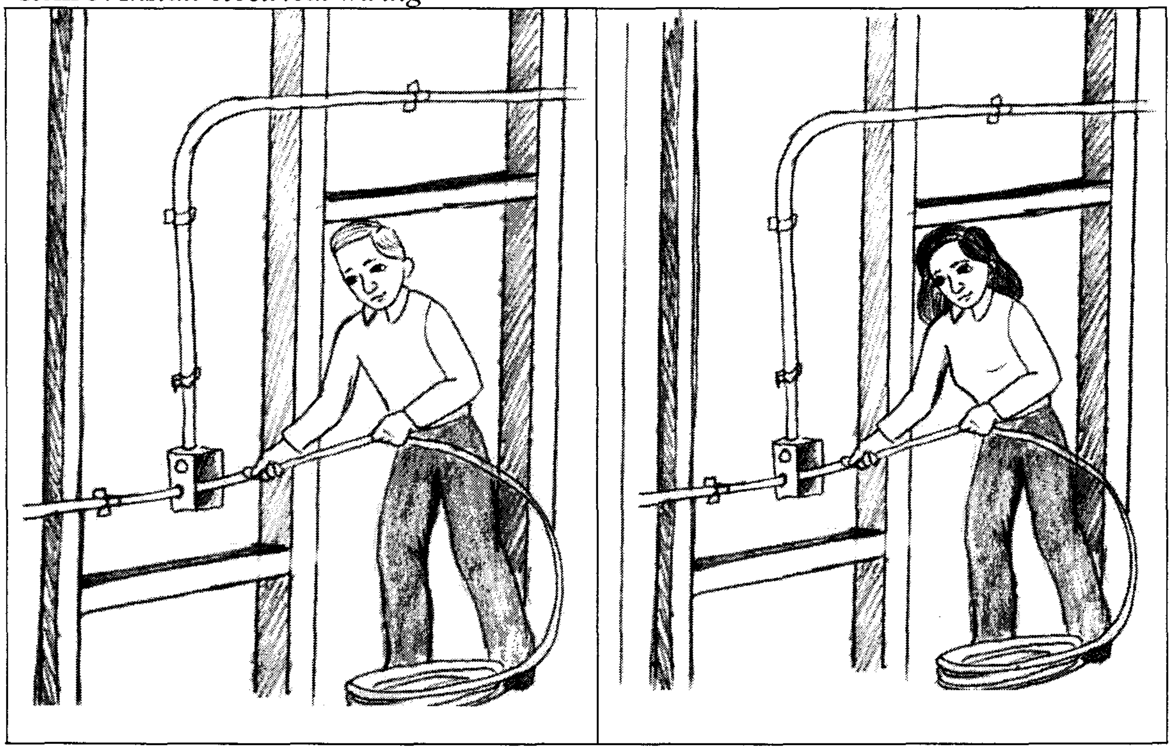
Item 3: *Prepare financial reports*



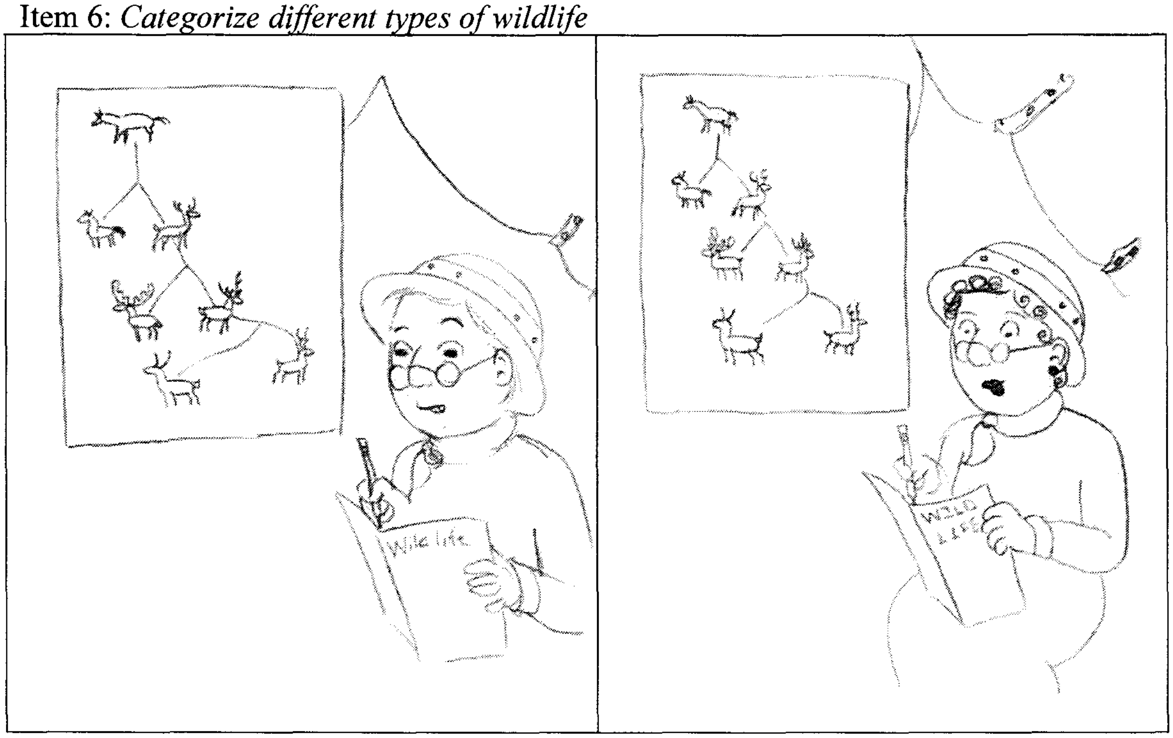
Item 4: *Oversee a data analysis group*



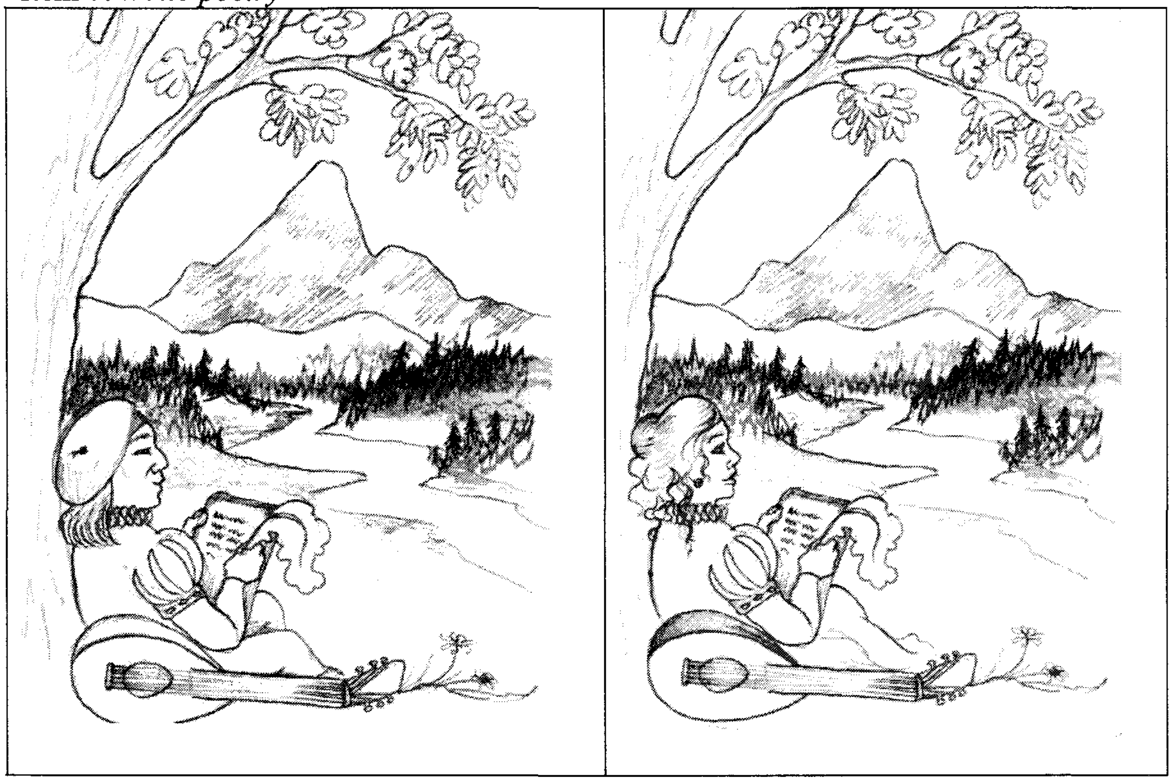
Item 5: *Install electrical wiring*



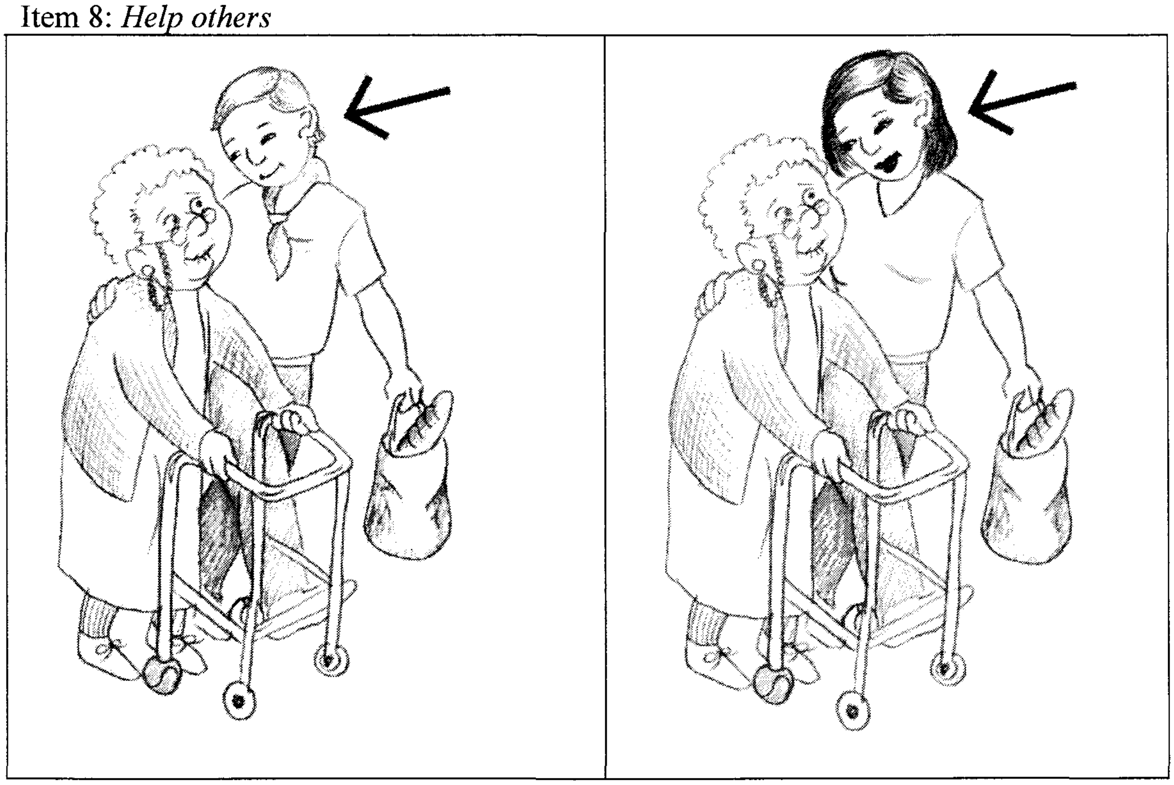
Item 6: *Categorize different types of wildlife*



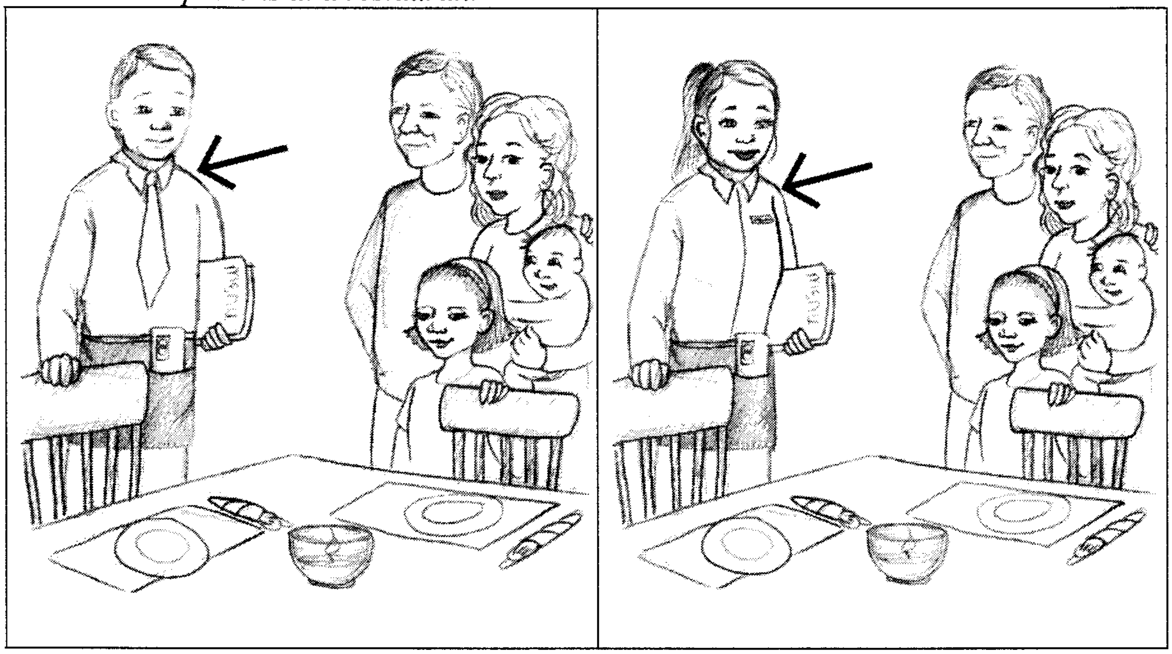
Item 7: *Write poetry*



Item 8: *Help others*

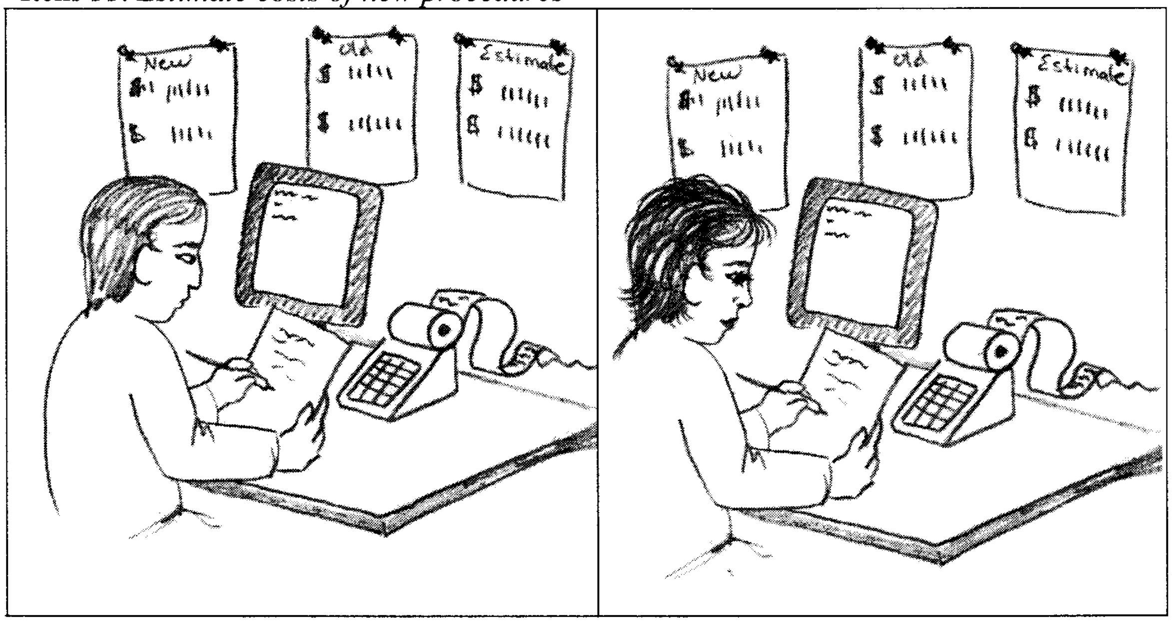


Item 9: *Seat patrons at a restaurant*

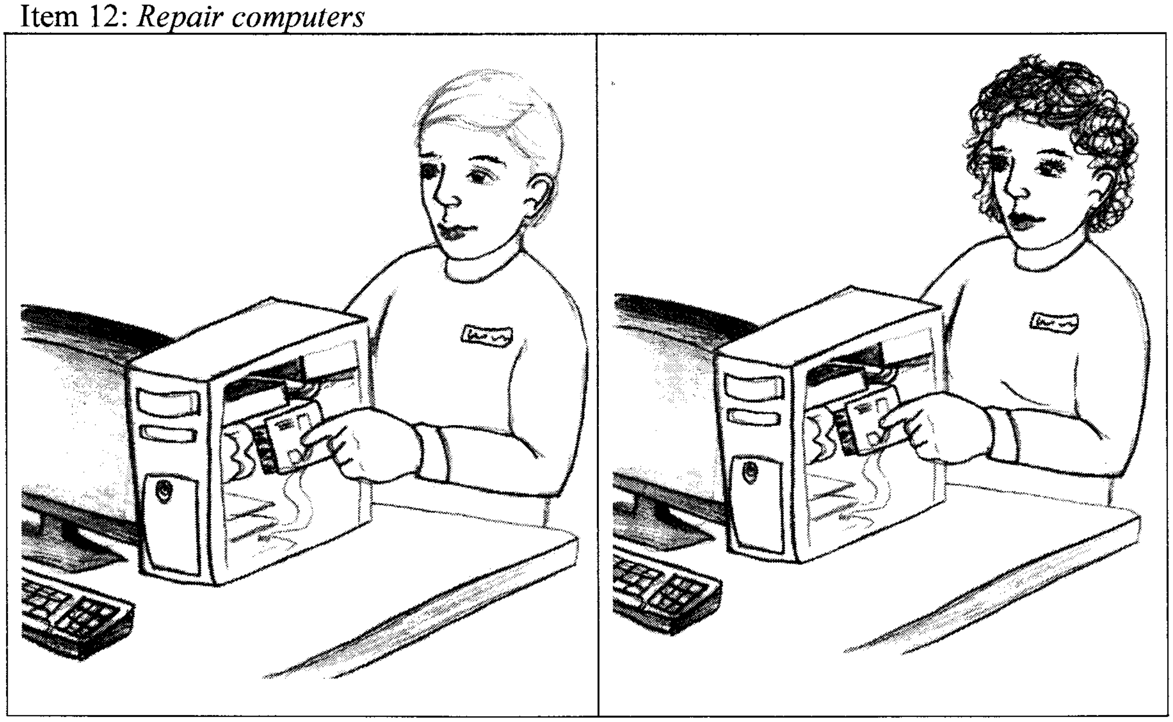


Item 10: *Sell goods to others*

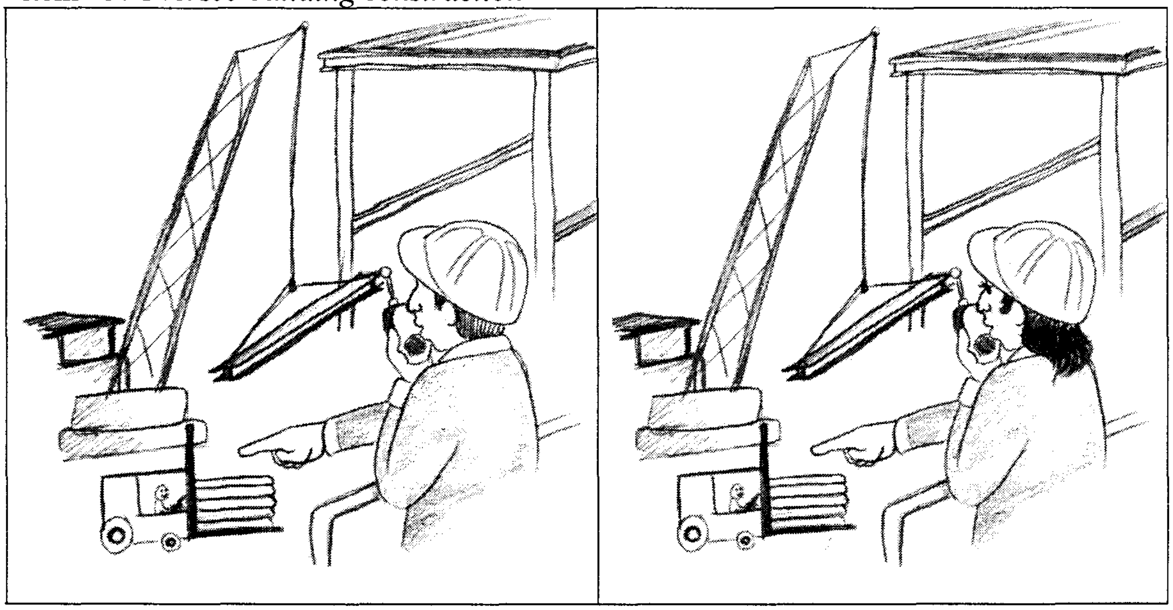
Item 11: *Estimate costs of new procedures*



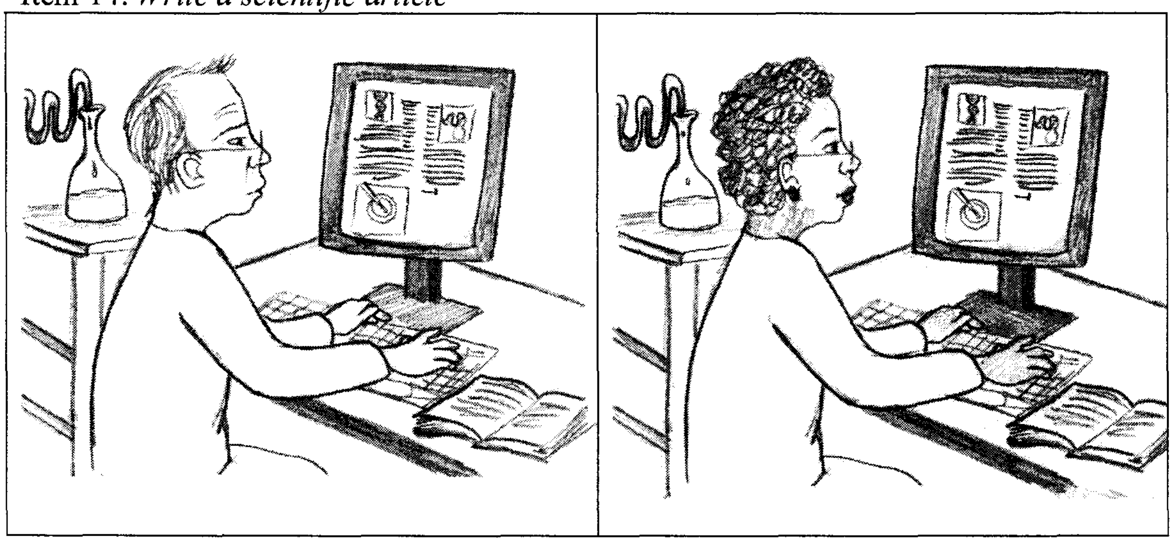
Item 12: *Repair computers*



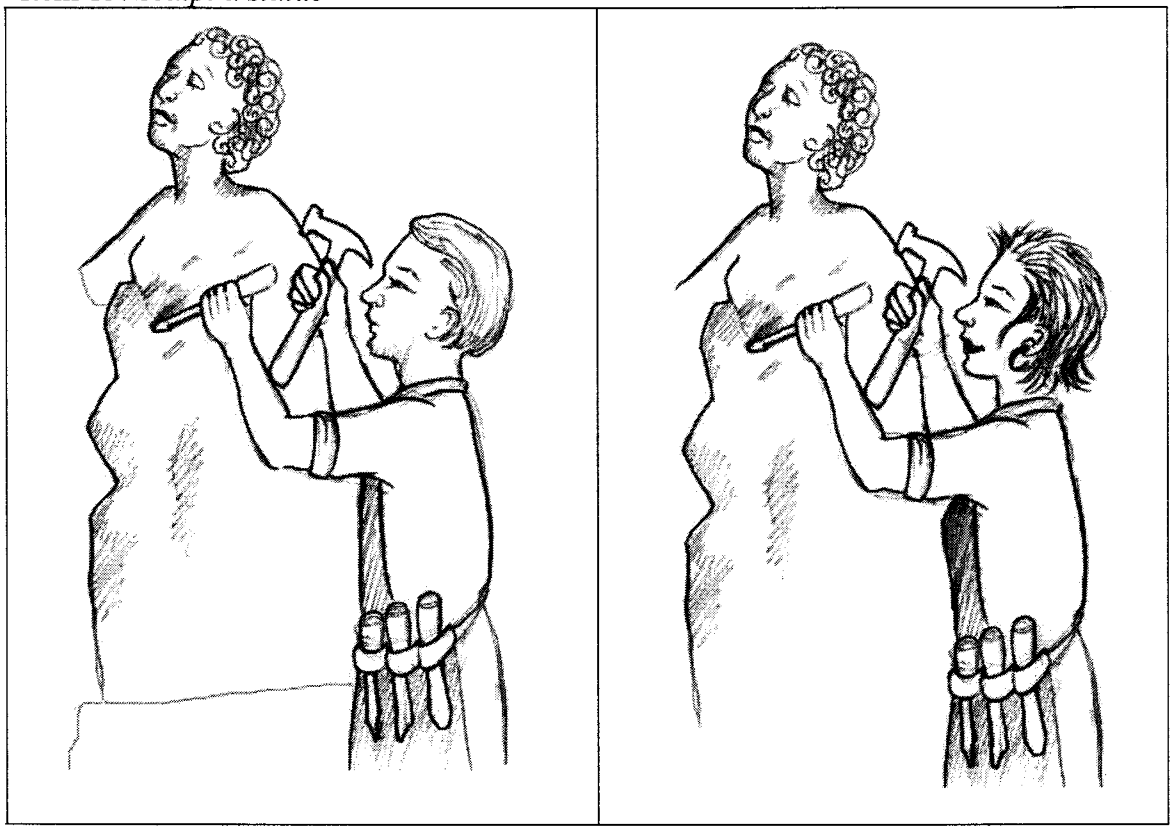
Item 13: *Oversee building construction*



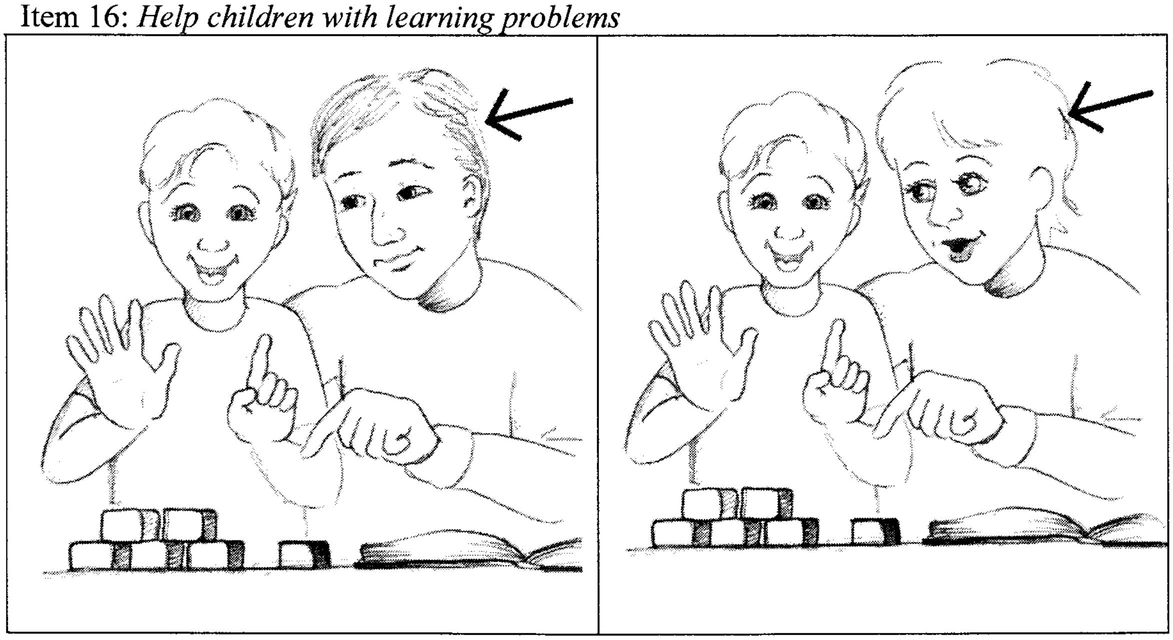
Item 14: *Write a scientific article*



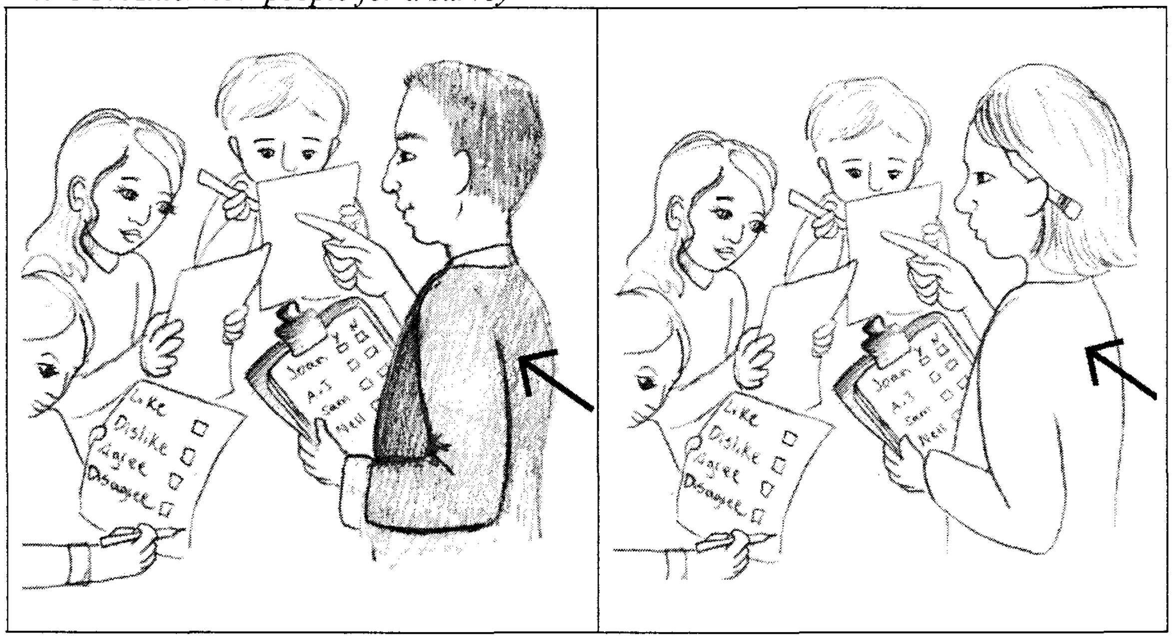
Item 15: *Sculpt a statue*



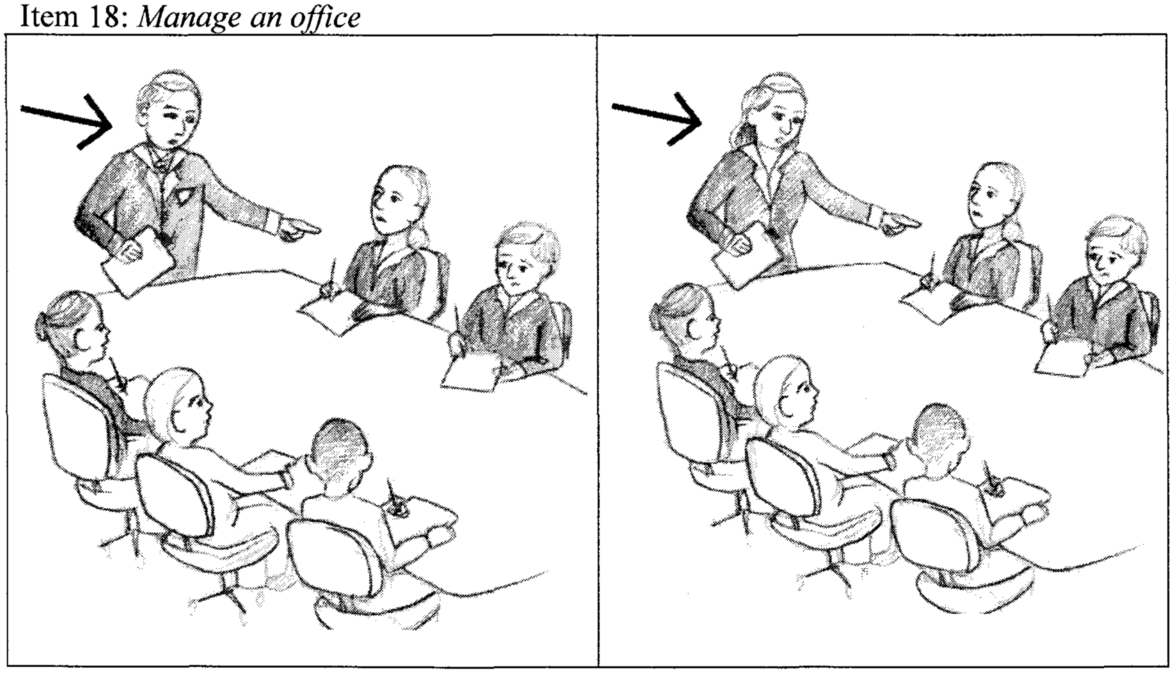
Item 16: *Help children with learning problems*



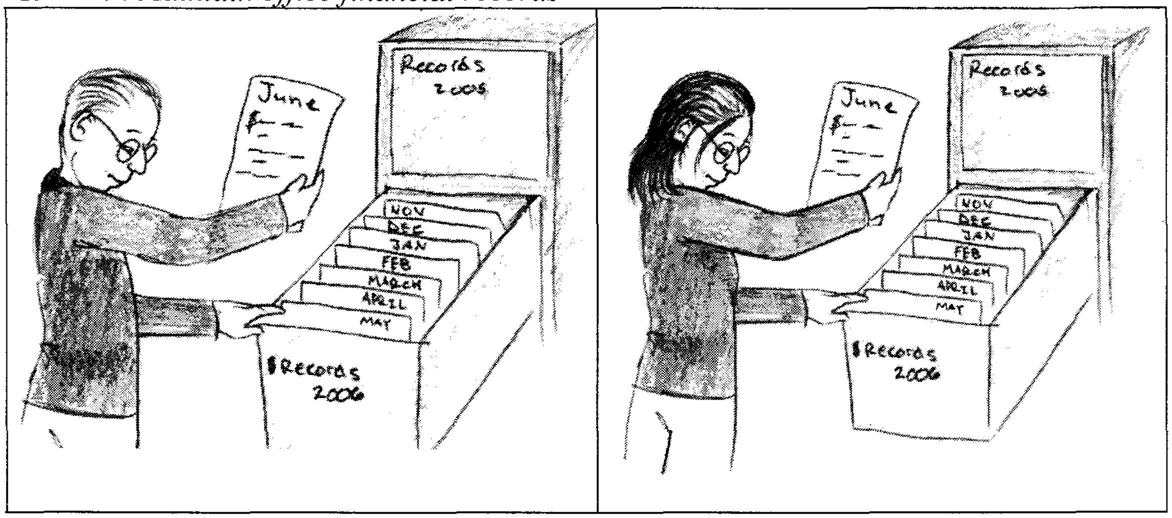
Item 17: *Interview people for a survey*



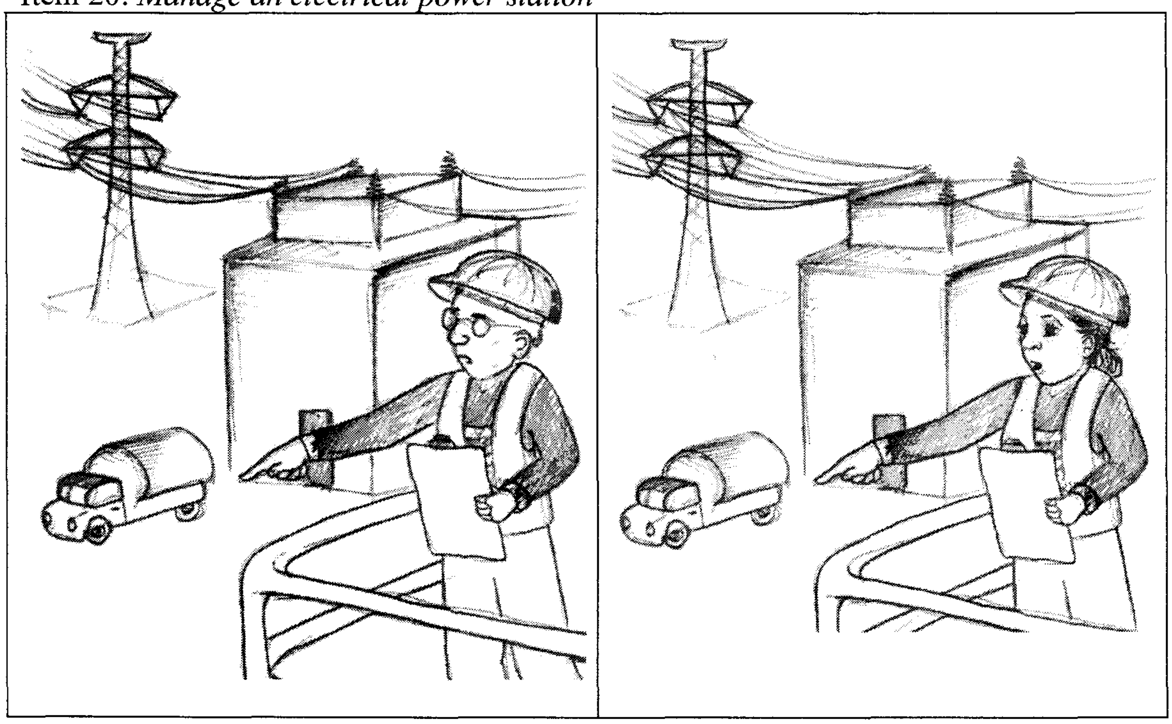
Item 18: *Manage an office*



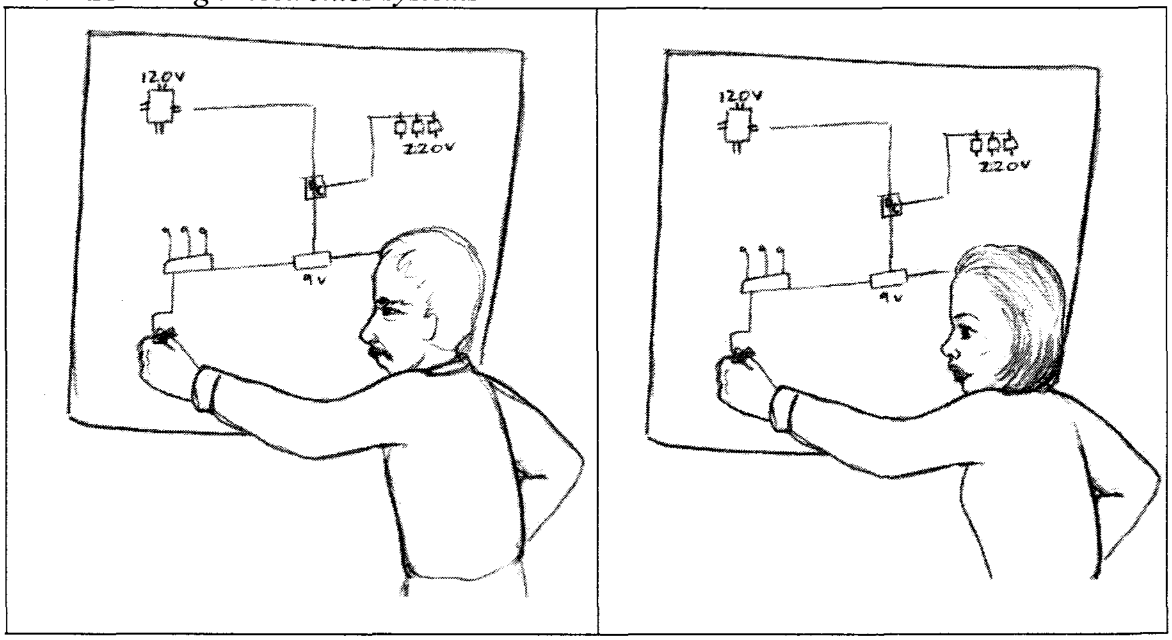
Item 19: *Maintain office financial records*



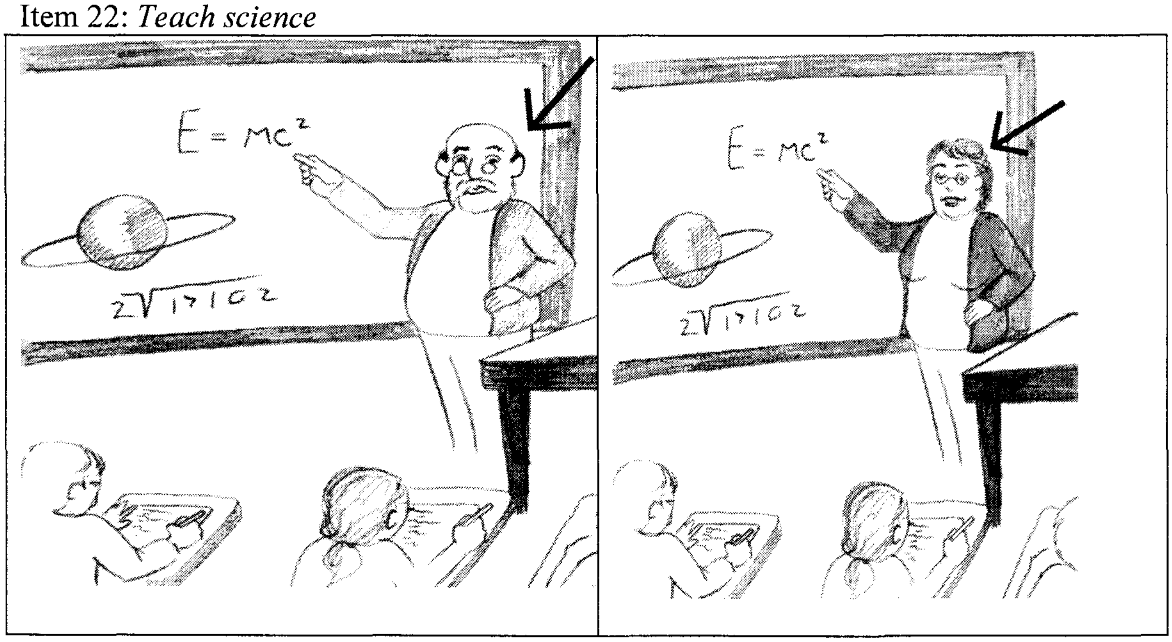
Item 20: *Manage an electrical power station*



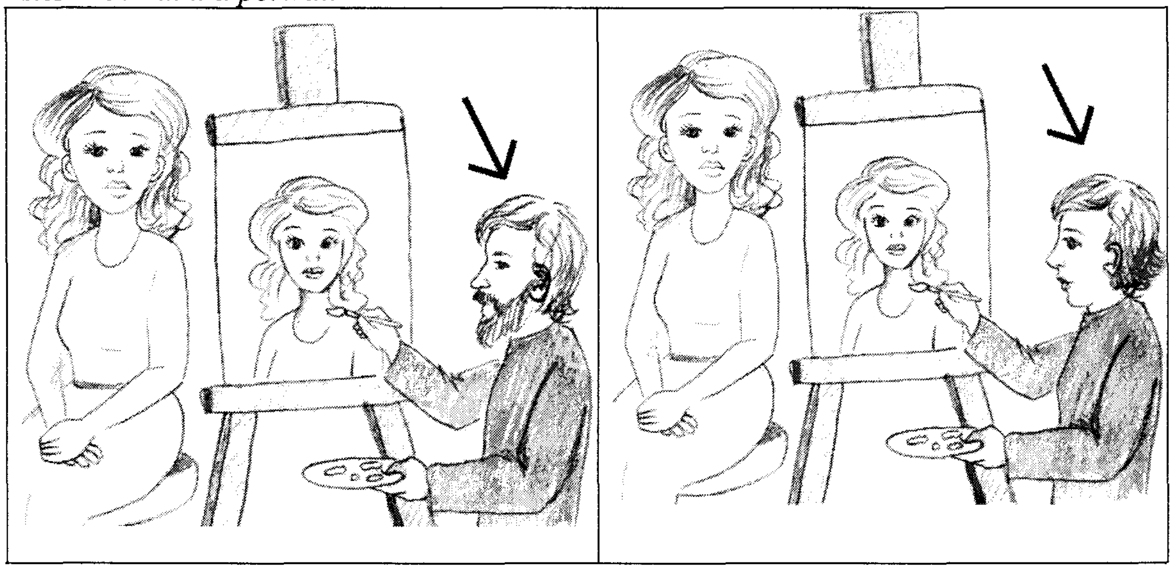
Item 21: *Design electronics systems*



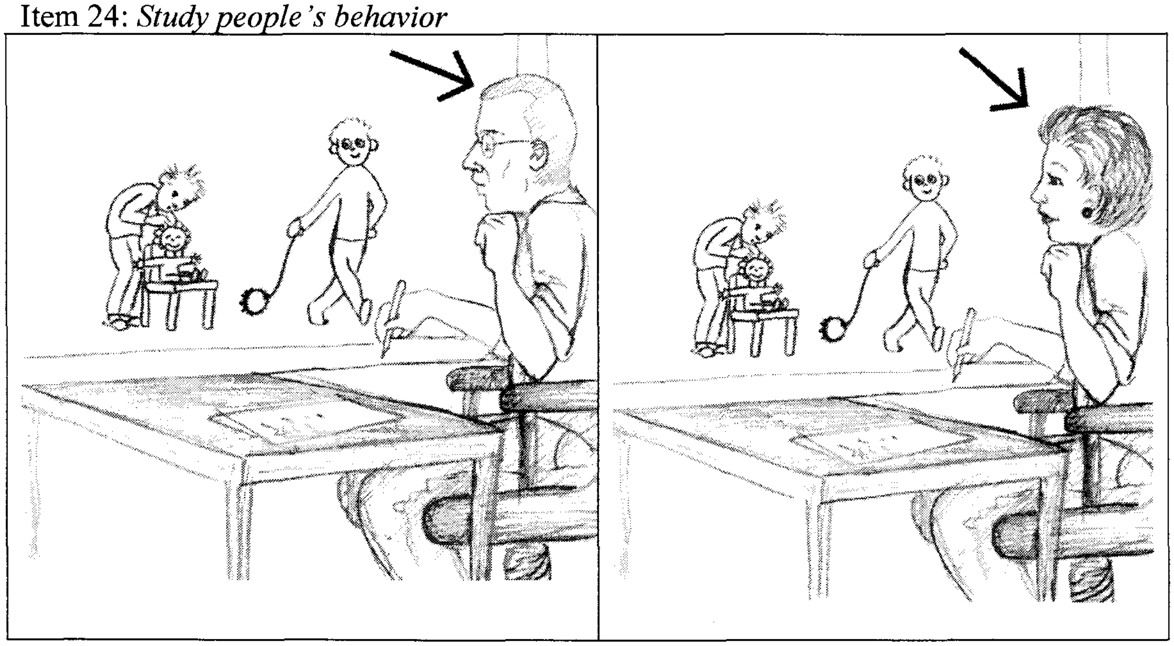
Item 22: *Teach science*



Item 23: *Paint a portrait*

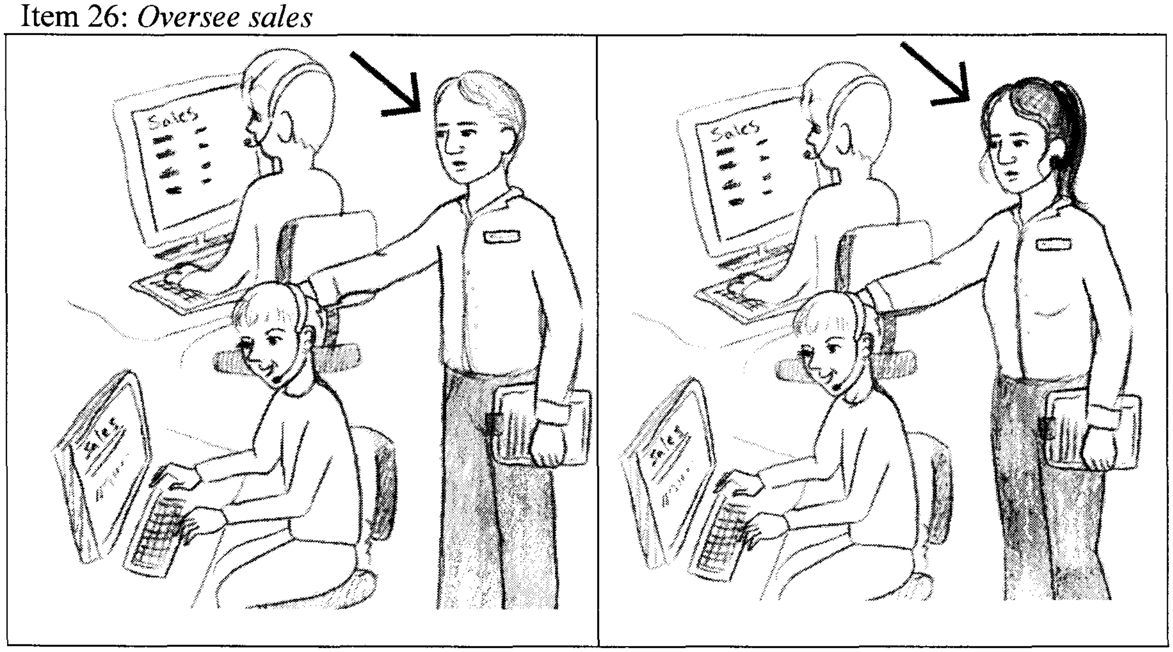


Item 24: *Study people's behavior*

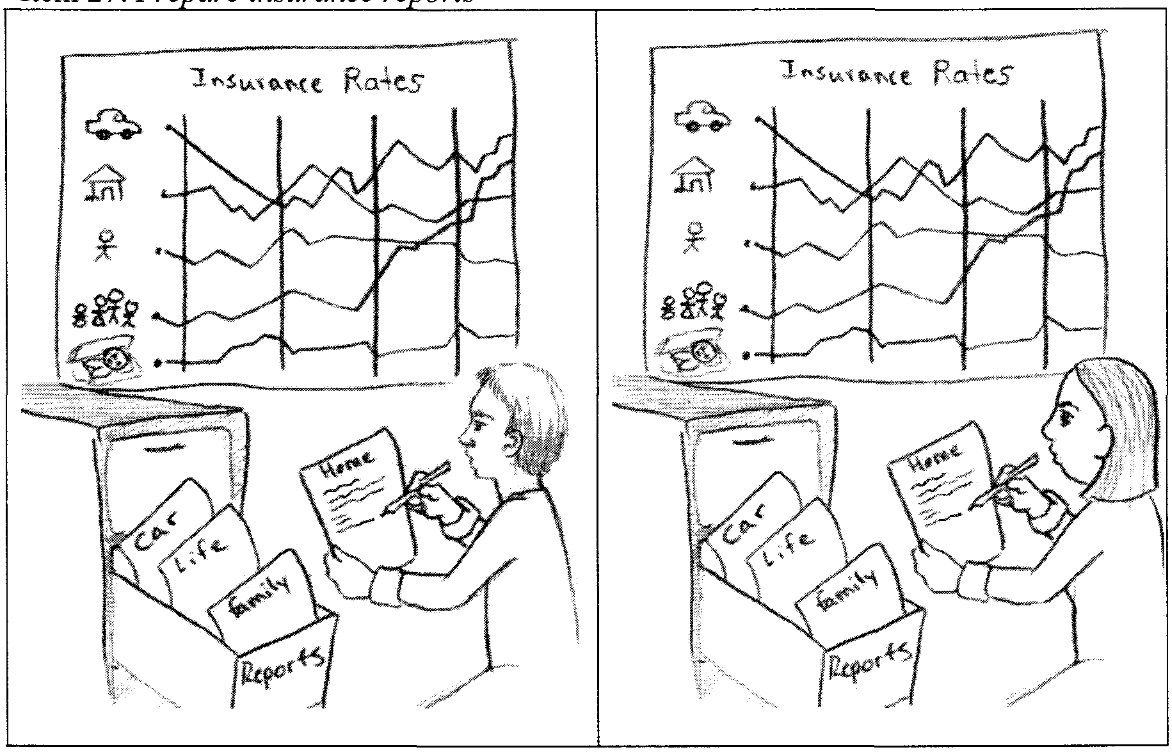


Item 25: *Sell clothes to others*

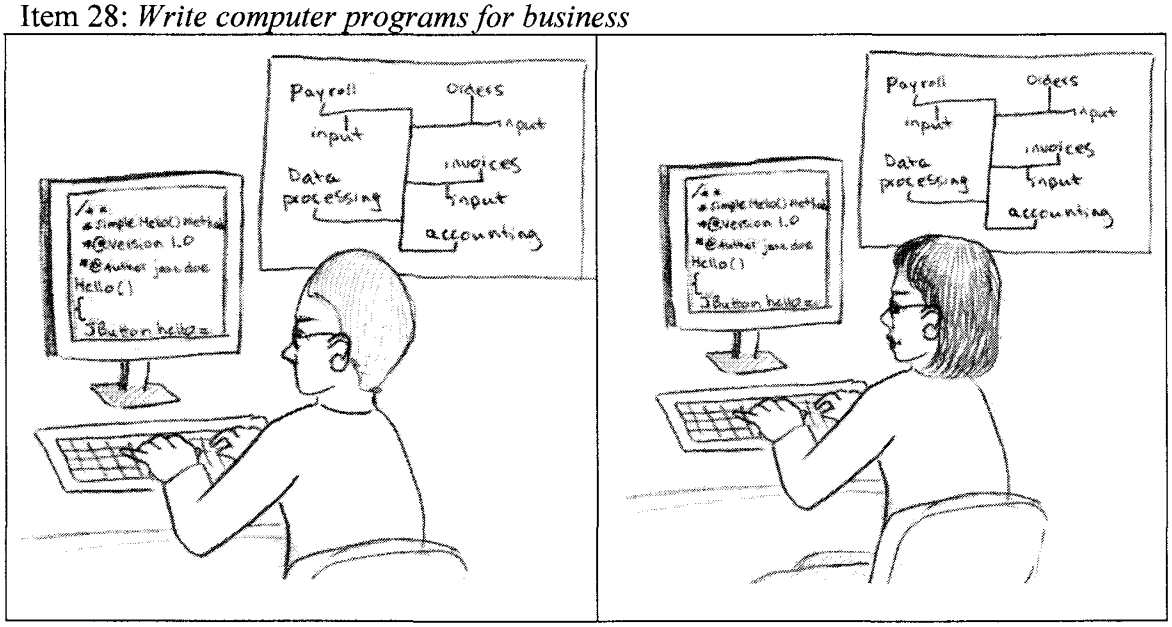
Item 26: *Oversee sales*



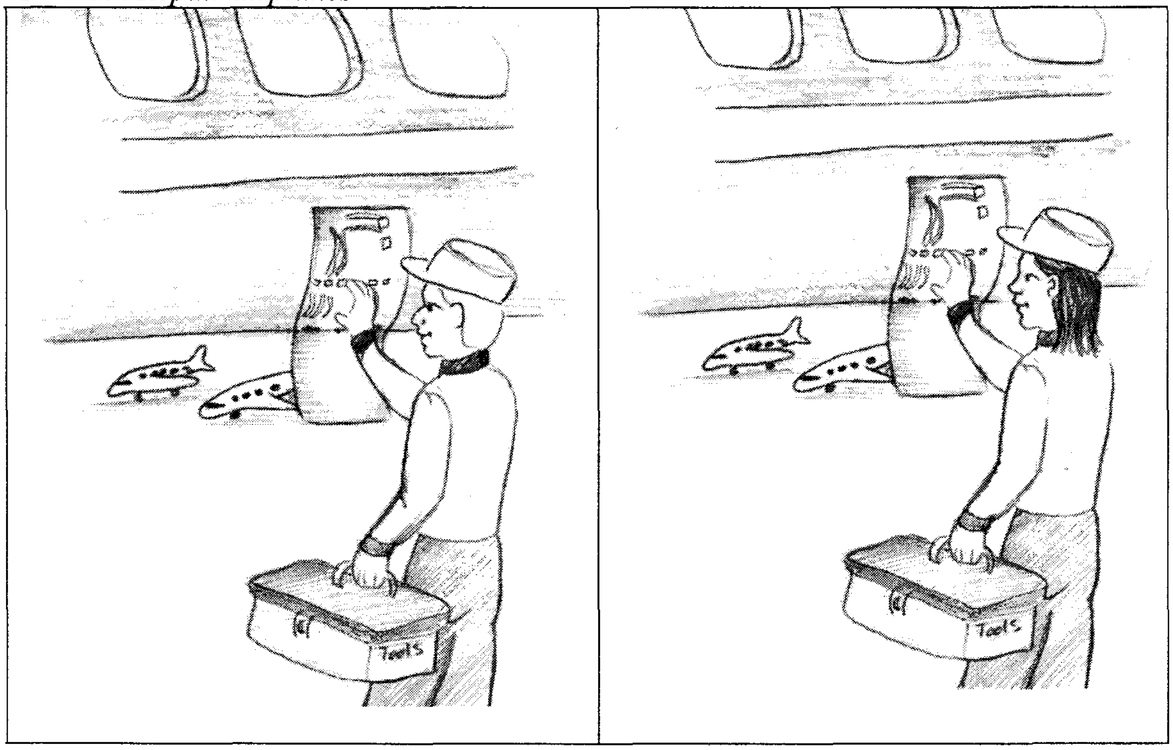
Item 27: *Prepare insurance reports*



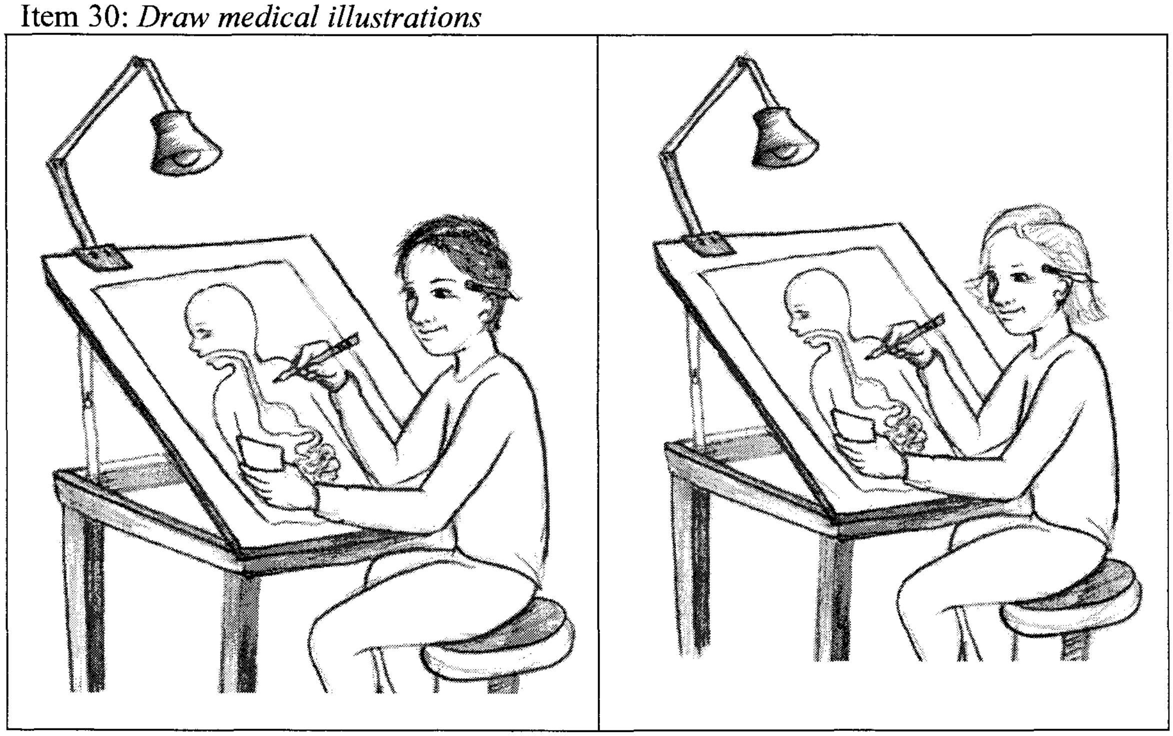
Item 28: *Write computer programs for business*



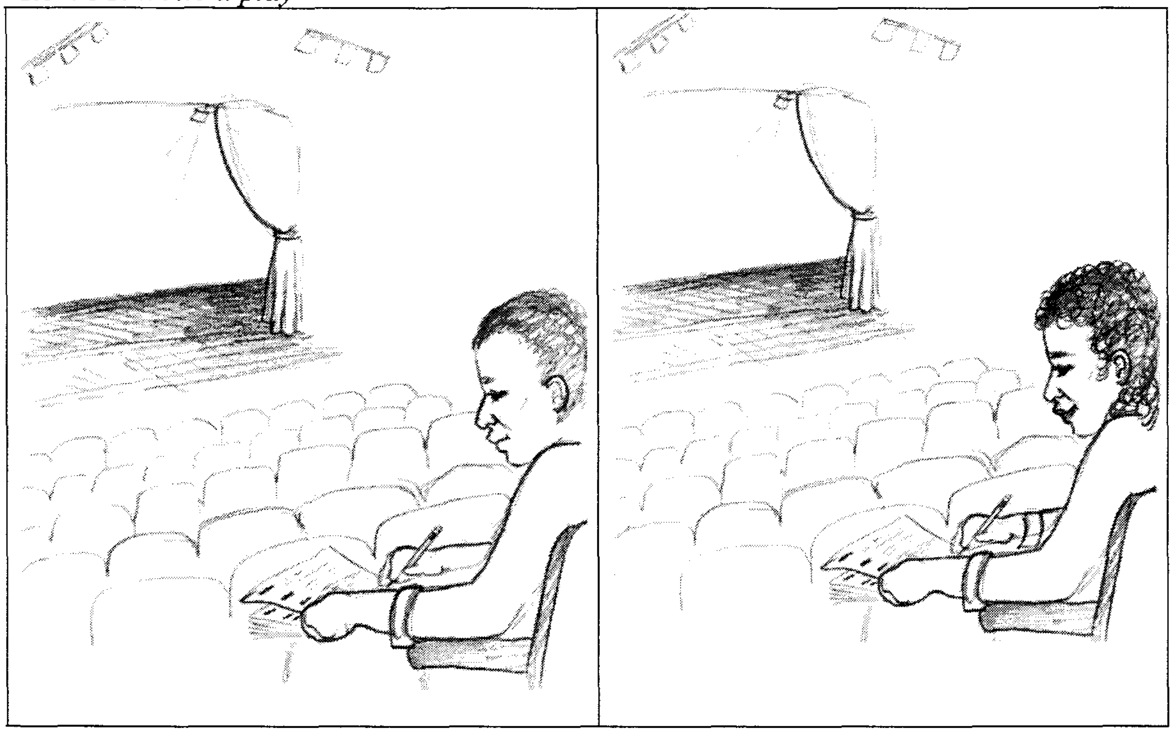
Item 29: *Repair airplanes*



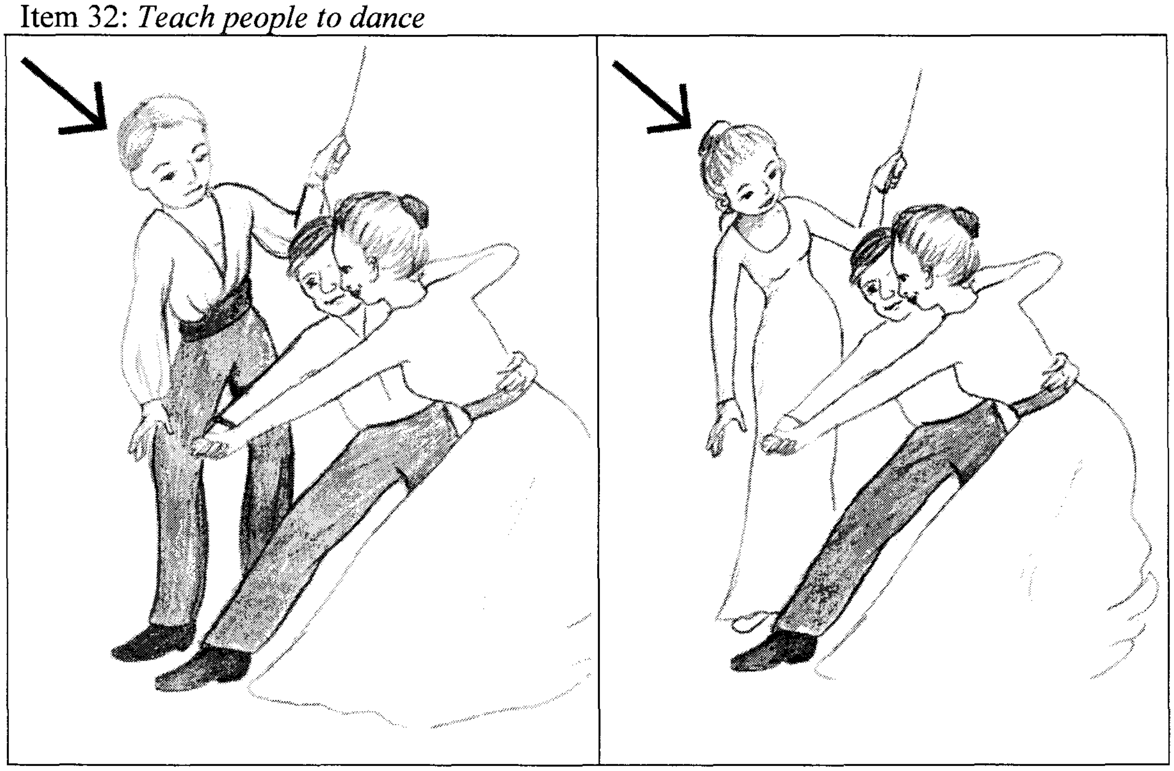
Item 30: *Draw medical illustrations*



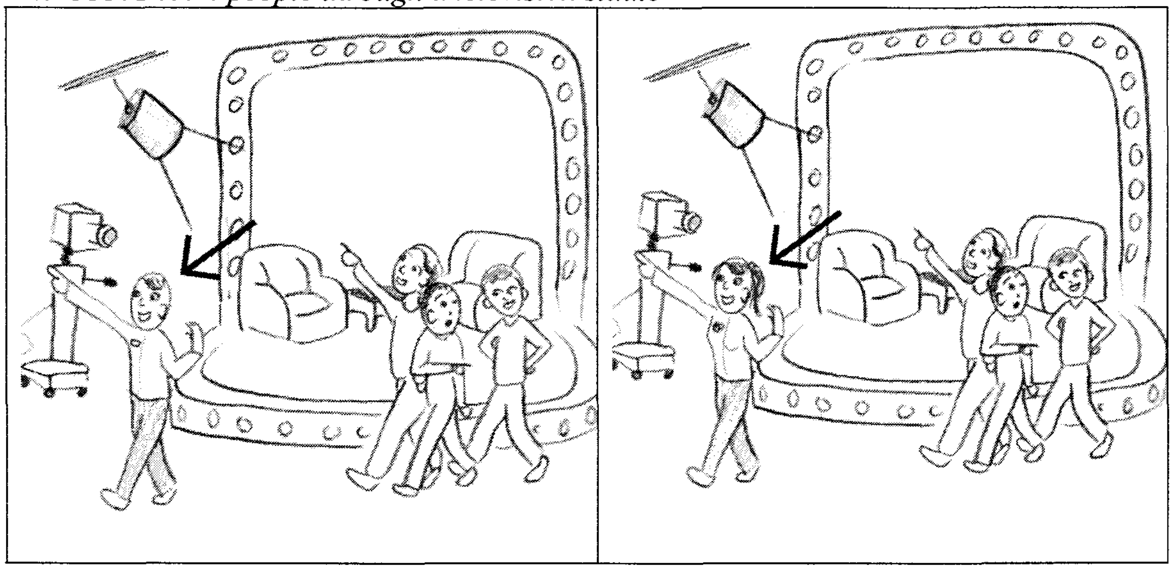
Item 31: *Write a play*



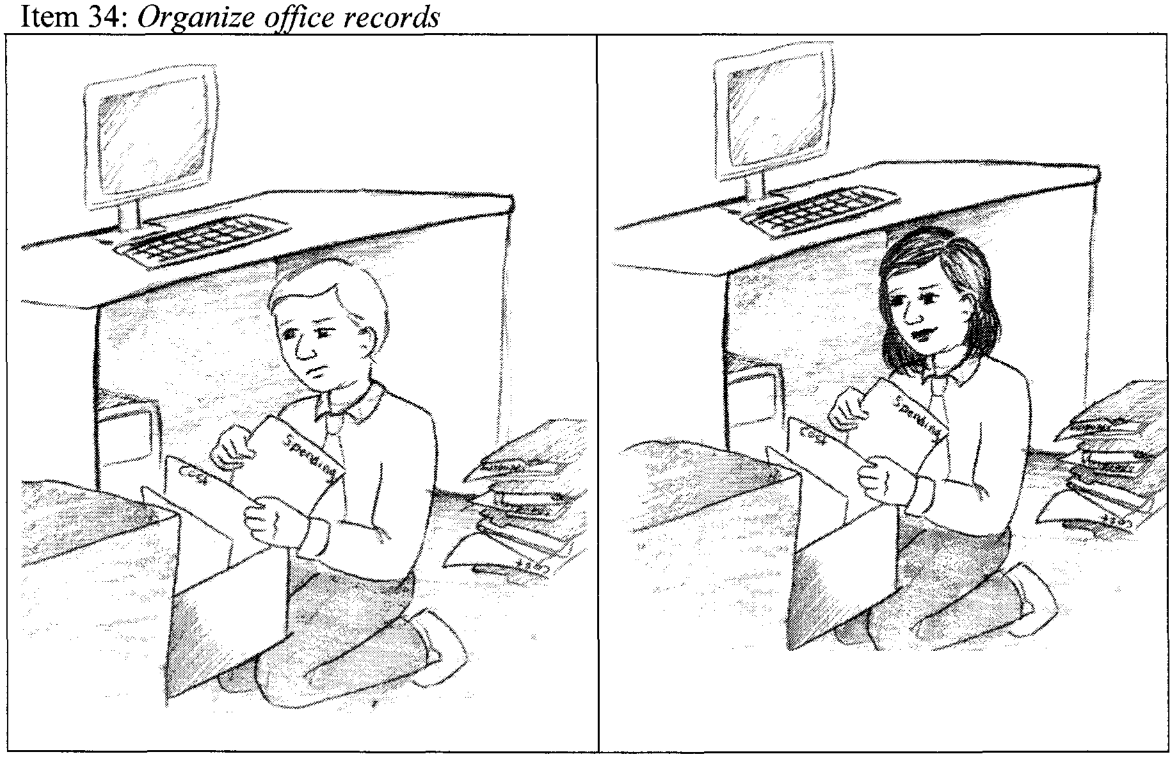
Item 32: *Teach people to dance*



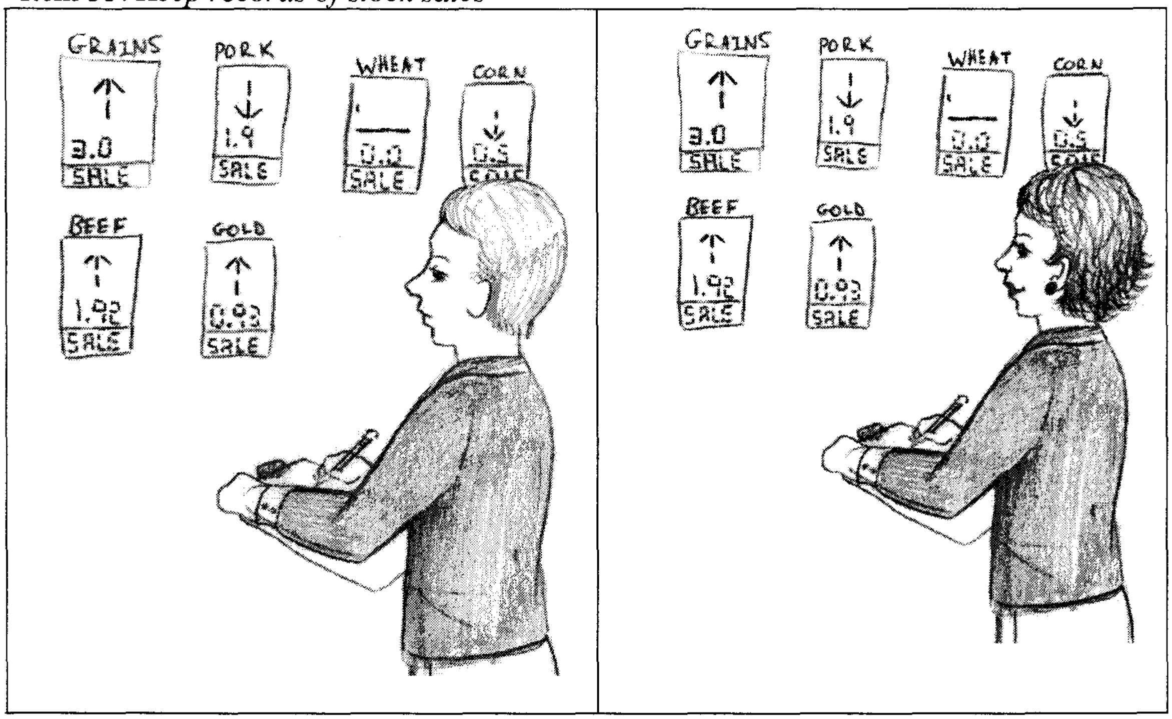
Item 33: *Escort people through a television studio*



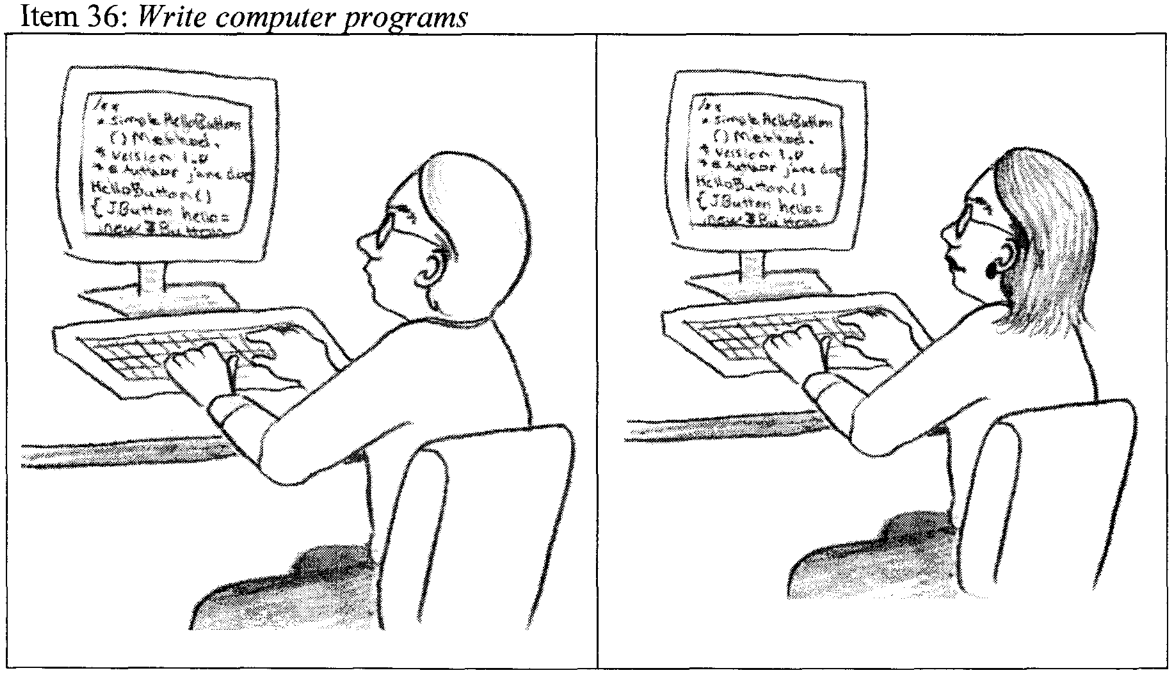
Item 34: *Organize office records*



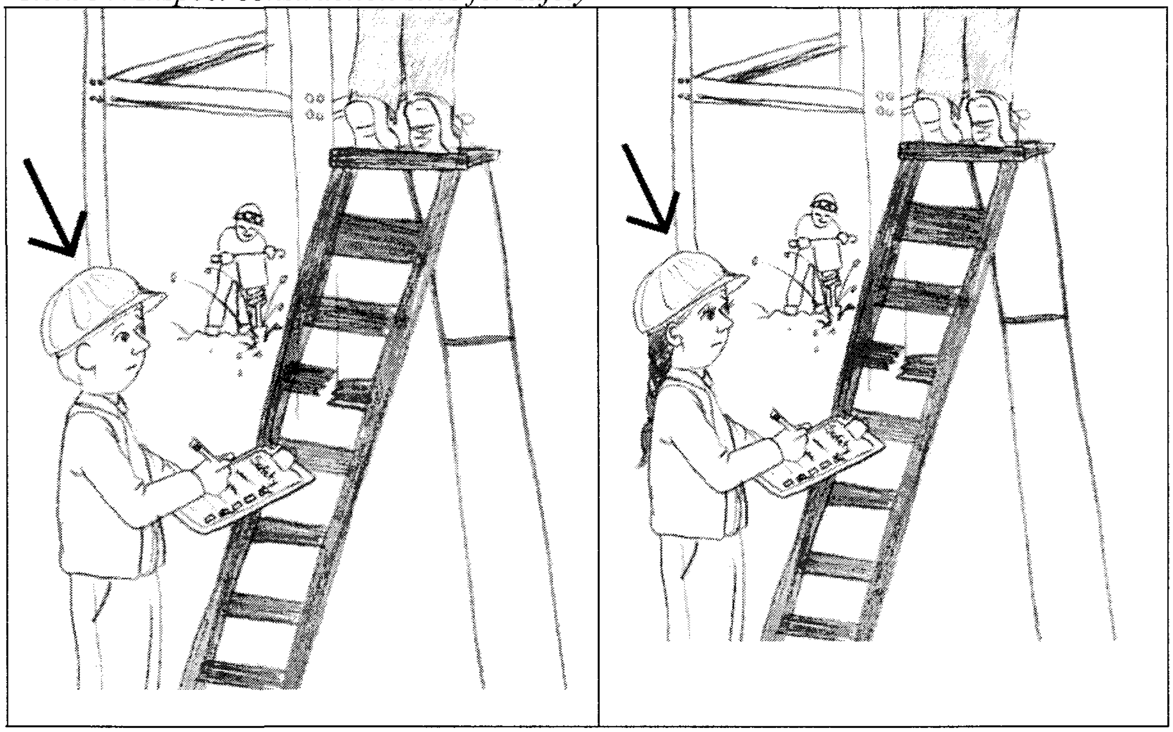
Item 35: *Keep records of stock sales*



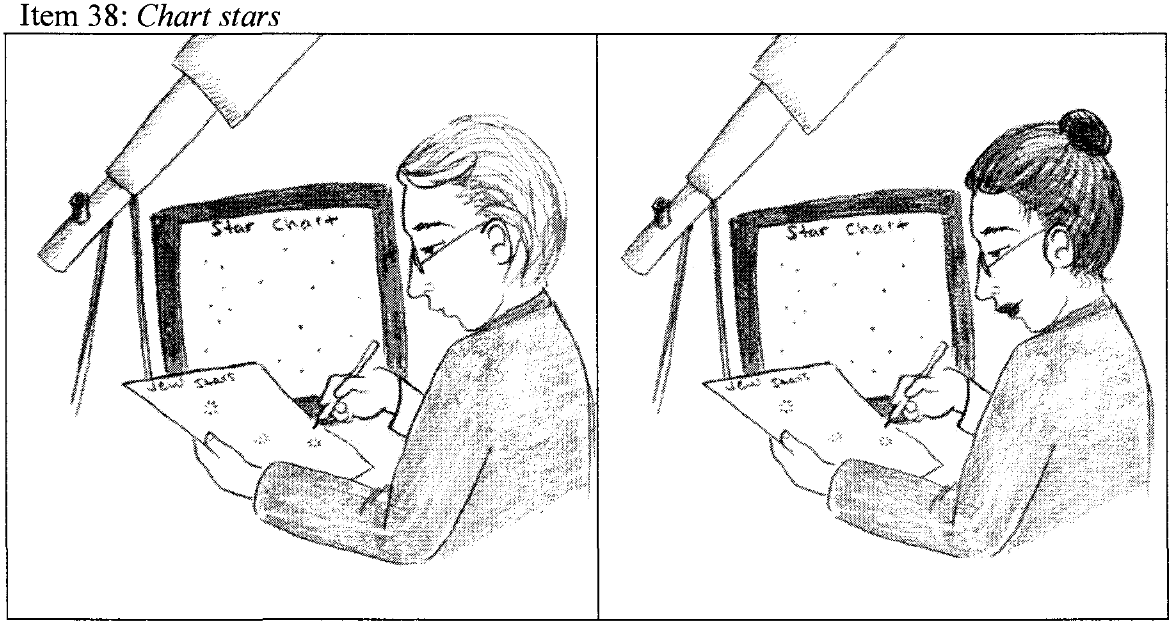
Item 36: *Write computer programs*



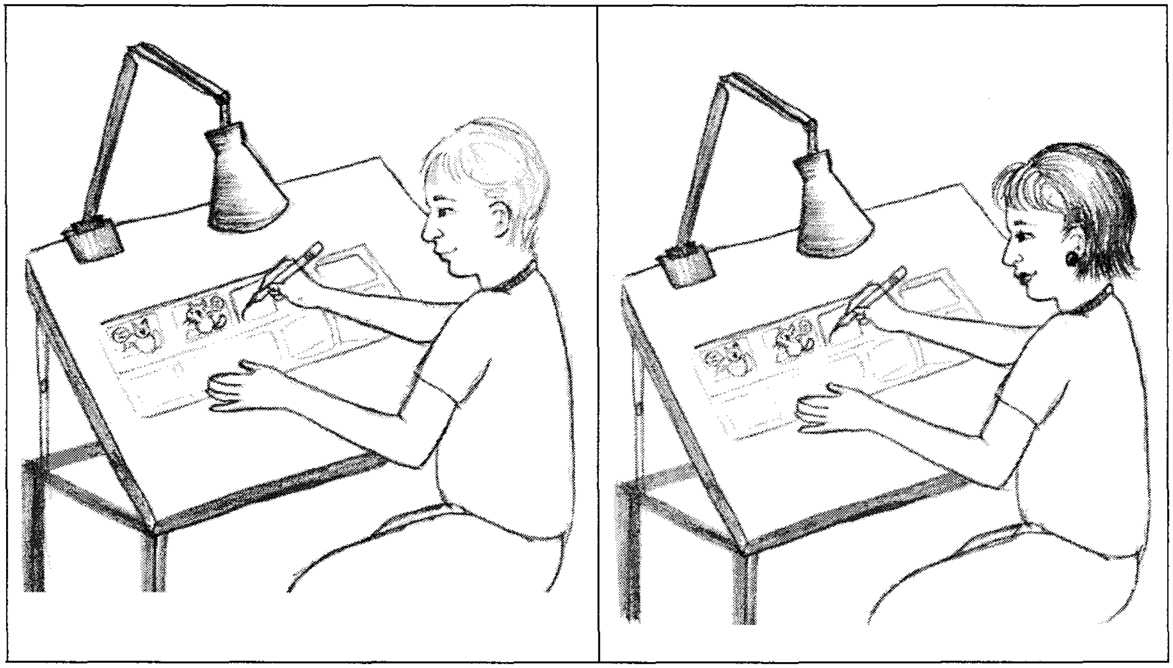
Item 37: *Inspect construction sites for safety*



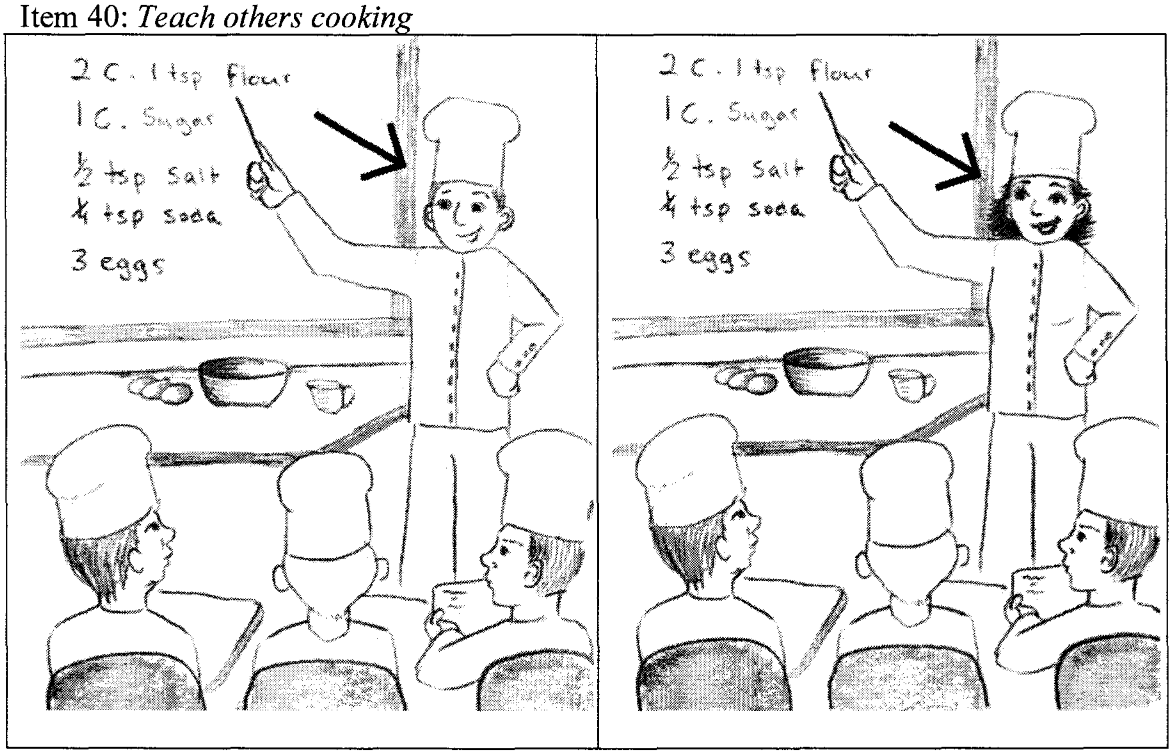
Item 38: *Chart stars*



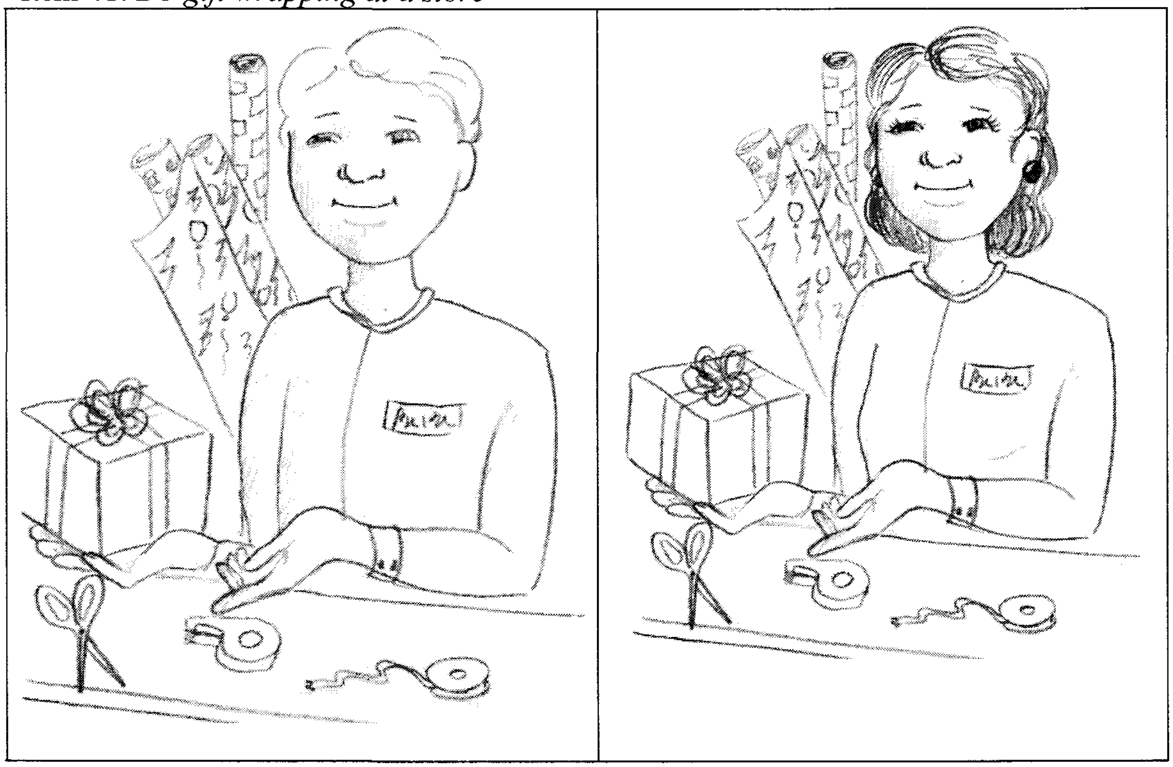
Item 39: *Draw cartoons*



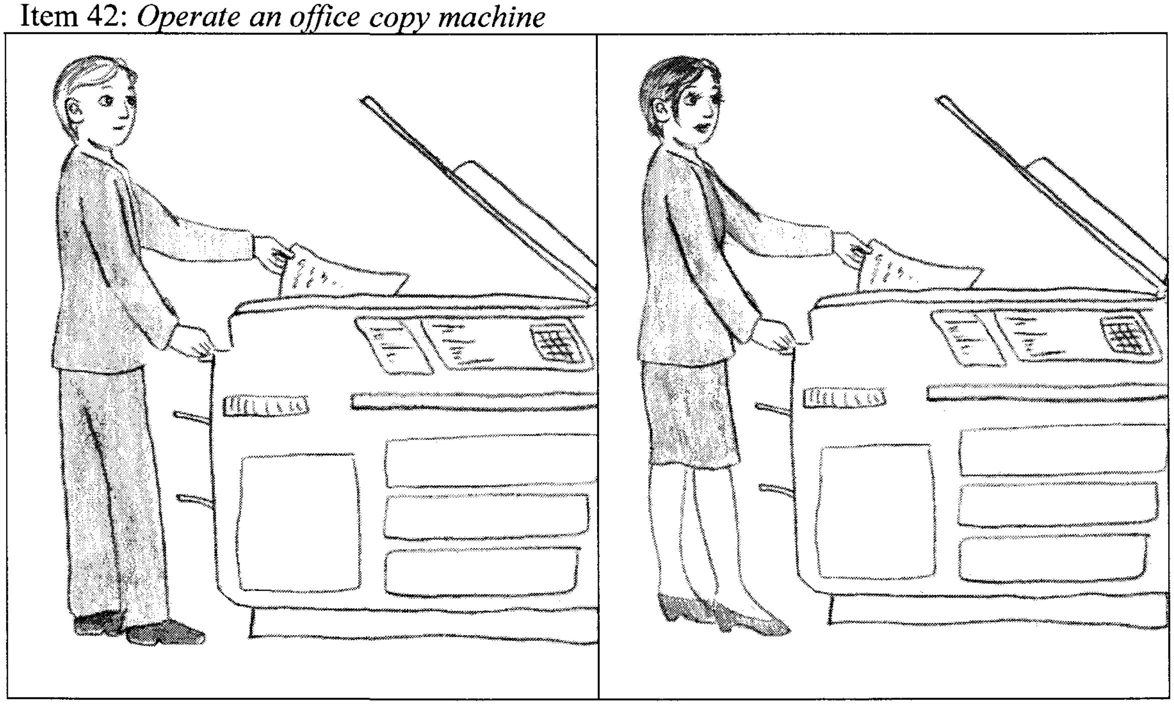
Item 40: *Teach others cooking*



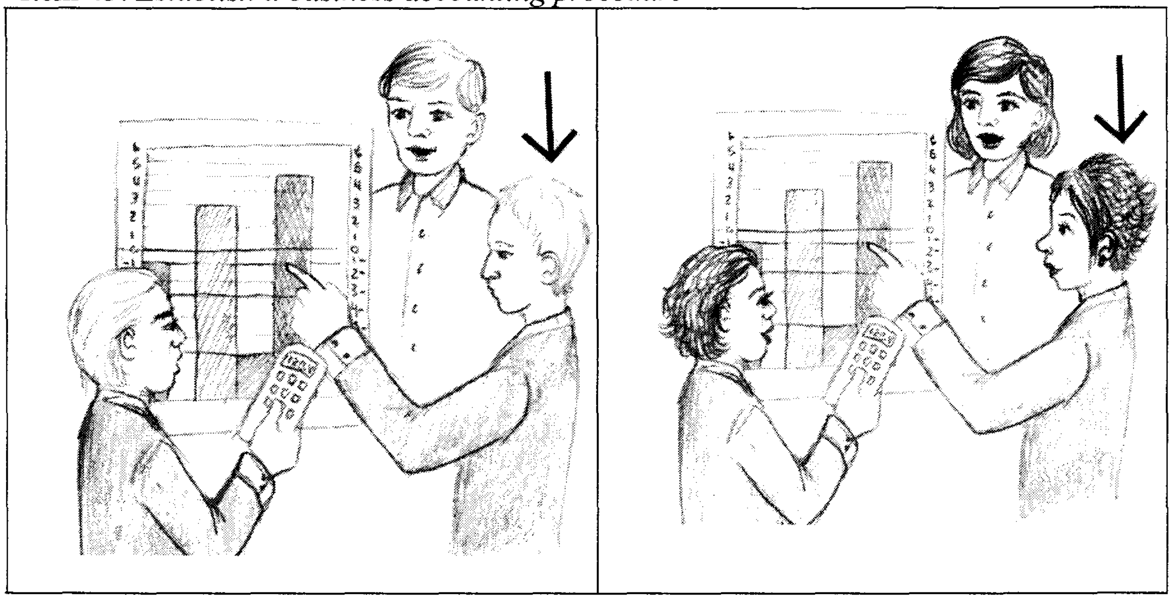
Item 41: *Do gift wrapping at a store*



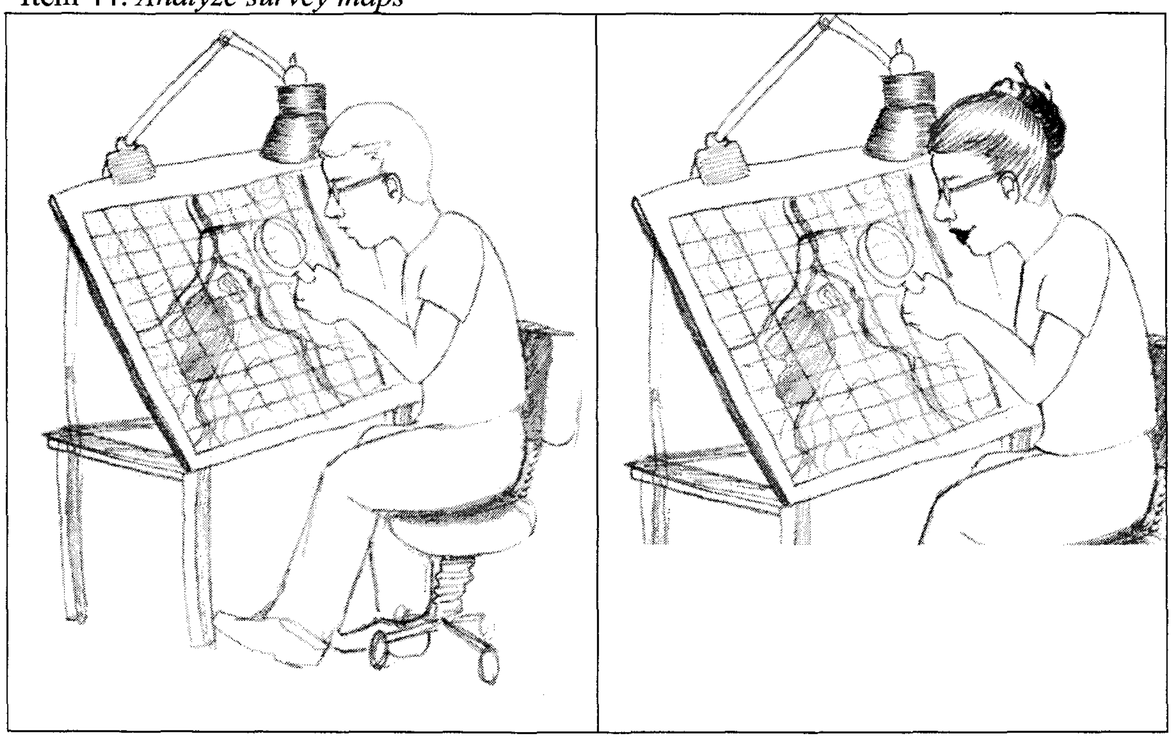
Item 42: *Operate an office copy machine*



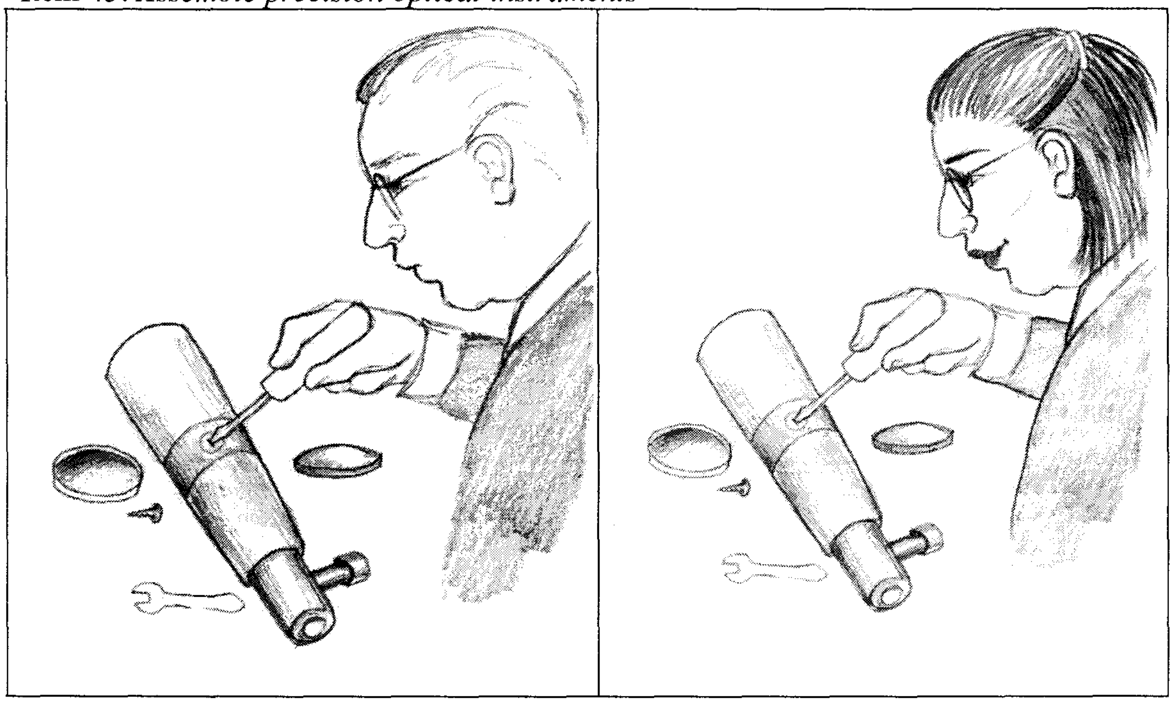
Item 43: *Establish a business accounting procedure*



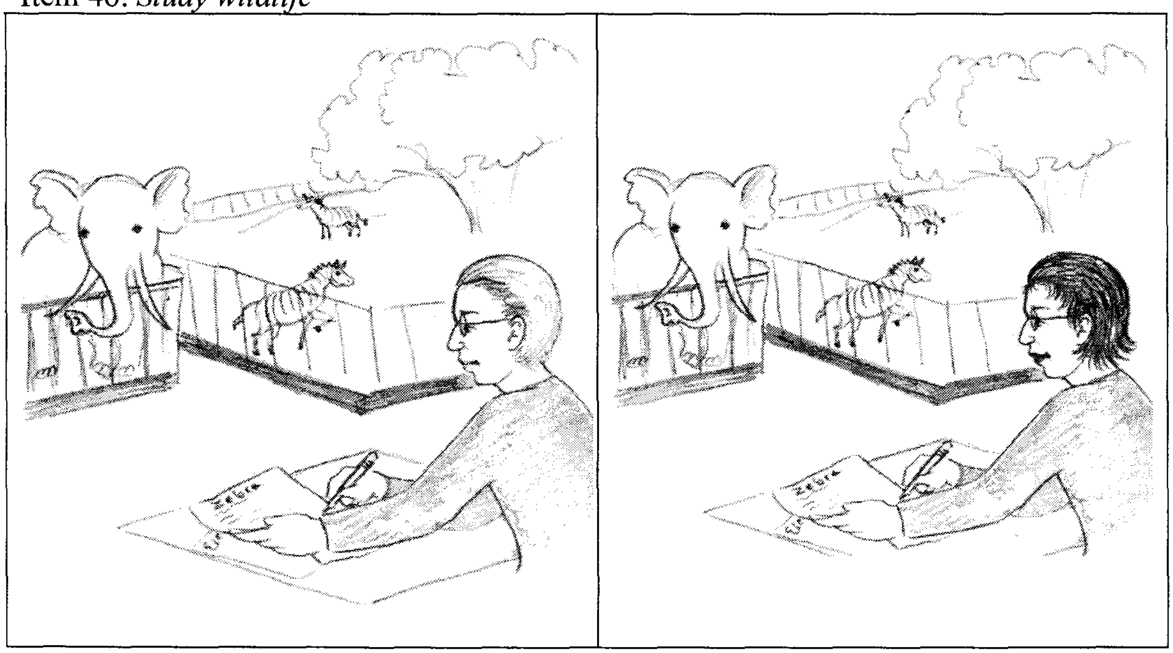
Item 44: *Analyze survey maps*



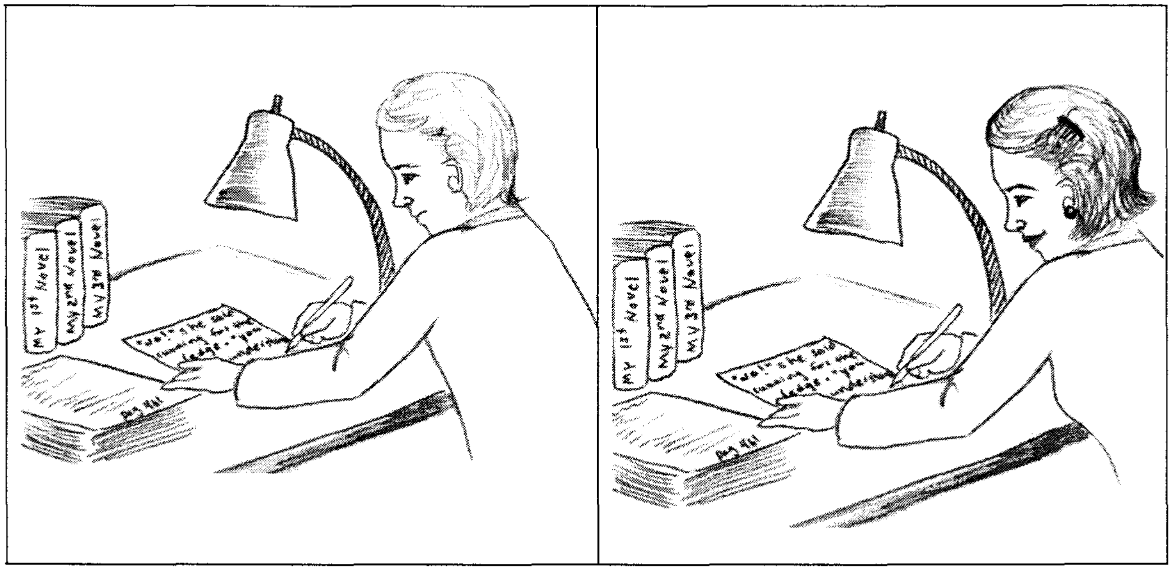
Item 45: *Assemble precision optical instruments*



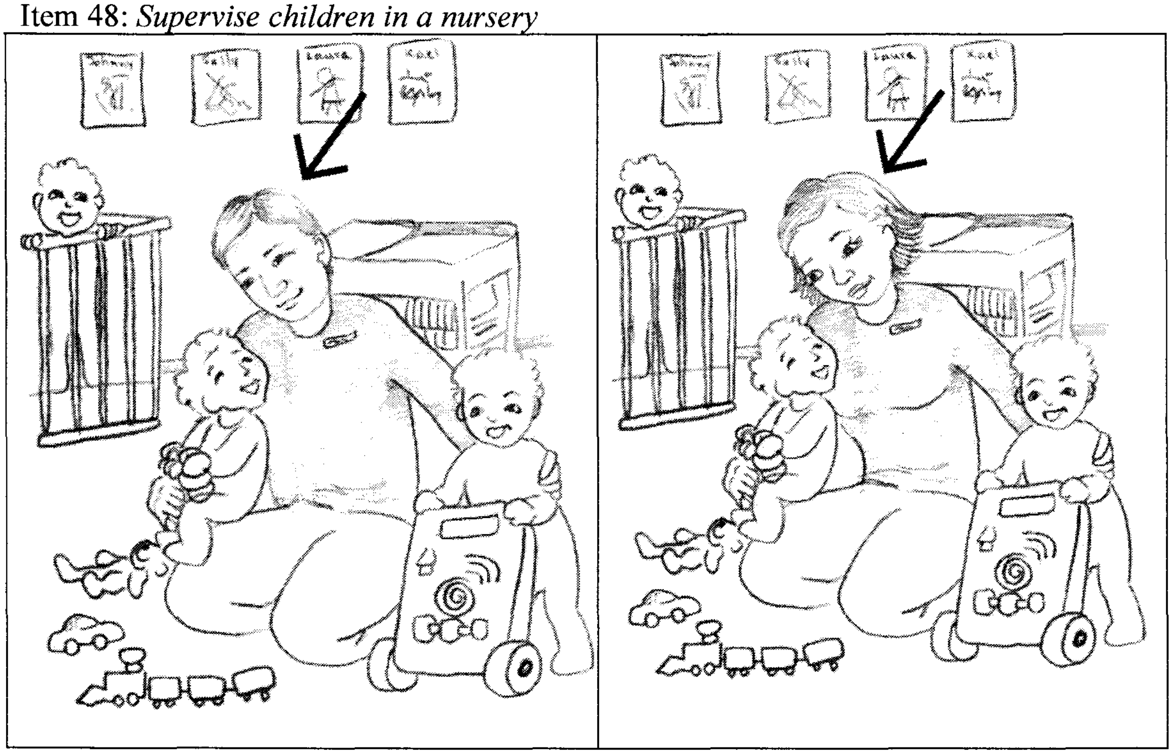
Item 46: *Study wildlife*



Item 47: *Write novels*



Item 48: *Supervise children in a nursery*



APPENDIX D: Verbal PGI-Pictorial PGI Correlations

Table D1: *Correlations between verbal PGI and pictorial PGI (Men)*

	Verbal	*R*	*I*	*A*	*S*	*E*	*C*
				Time 1			
Pictorial	R	0.64	0.13	-0.04	-0.04	0.20	0.39
	I	0.15	0.67	0.35	0.27	0.08	0.06
	A	-0.03	0.41	0.71	0.45	0.13	-0.12
	S	0.01	0.26	0.36	0.66	0.40	-0.05
	E	0.17	-0.02	-0.02	0.21	0.57	0.29
	C	0.34	0.00	-0.17	-0.14	0.36	0.60
				Time 2			
Pictorial	R	0.83	0.23	0.06	0.14	0.35	0.53
	I	0.27	0.79	0.49	0.38	0.19	0.21
	A	0.04	0.44	0.83	0.54	0.13	-0.10
	S	0.15	0.37	0.53	0.84	0.49	0.07
	E	0.35	0.10	0.09	0.43	0.78	0.54
	C	0.49	0.10	-0.13	0.03	0.53	0.81

Table D2: *Correlations between verbal PGI and pictorial PGI (Women)*

	Verbal	*R*	*I*	*A*	*S*	*E*	*C*
				Time 1			
Pictorial	R	0.68	0.29	0.08	-0.02	0.11	0.47
	I	0.39	0.72	0.31	-0.03	-0.03	0.26
	A	0.15	0.32	0.80	0.23	0.06	0.01
	S	0.10	0.10	0.30	0.76	0.47	0.06
	E	0.21	0.00	0.12	0.50	0.69	0.30
	C	0.42	0.23	-0.05	-0.02	0.27	0.71
				Time 2			
Pictorial	R	0.80	0.34	0.13	0.02	0.21	0.55
	I	0.50	0.85	0.40	0.01	0.04	0.37
	A	0.20	0.40	0.89	0.28	0.12	0.09
	S	0.12	0.20	0.42	0.87	0.57	0.09
	E	0.23	0.06	0.21	0.61	0.82	0.31
	C	0.52	0.28	-0.01	0.01	0.38	0.82