A Study on the Recruitment and Job Performance of Newly Recruited Product Designers and Their Implications in Design Education

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Abstract

One of the key issues for managerial staffs to select the best personnel from numerous job applicants. This study used a questionnaire to ask both the design managers of manufacturing companies and the managers of design companies regarding the methods and criteria used to recruit new industrial designers, as well as

surveying their satisfaction with the job performance of newly recruited industrial designers. The relationship between the method used to recruit new industrial designers and manager satisfaction with the job performance of newly recruited industrial designers was also explored. We hope that the results presented here can provide a reference for assisting the related managers in selecting appropriate new industrial designers for firms and design educational line to create suitable curriculum and teaching contents to adequately equip novice designers for their work. The essential findings of the study are:

1. All the companies use face-to-face interview in the recruitment of industrial designers, 97% companies use portfolio, 38% adopt written test of aptitude test and English, and 16% adopt the right on the spot test of project design. The companies adopt written tests are the manufacturing companies of which the test is required to every newly recruited employee while only design companies have the right on the spot test to check the ability of the applicant in sketching and computer-aided design.

2. The top five criteria in the recruitment of new industrial designers are creativity, product form design ability, design quality, awareness of design trend, and sense of aesthetics; the lowest five criteria are having certificates of design skill, having award winning records, other specialties, knowledge of marketing strategy, and educational background. There exist significant differences of selection criteria among managers with different backgrounds, firm scales and business types.

3. The three performance items of newly recruited industrial designers that managers satisfy the most are schedule control ability, sense of aesthetics, and computer aided design software manipulating ability; the three worst items are free hand sketch, knowledge of engineering & manufacturing, and product planning abilities. There exist significant differences in the manager's satisfaction toward newly recruited industrial designers' job performance among different ways of recruitment.

Keywords: Industrial Designers, Personnel Recruitment, Recruitment Method, Job Performance

1. Introduction

In the current changing environment, enterprises must be able to respond rapidly to change. Such ability to respond frequently depends upon the quality of enterprise personnel. Therefore, the competitiveness of modern enterprises almost equals the competitiveness of enterprise personnel (Werther and Davis, 1993). Excellent personnel perform tasks well and will significantly impact team effectiveness (Drucker, 1964). New product design and development requires integrating the elite in a company but it is difficult to find suitable R&D personnel. However, it is important to recruit such personnel if possible. It is unwise to stifle talented personnel (Ulrich and Eppinger, 2000). Industrial designers play a key role during the new product design and development stages of enterprises, and are a key human resource. In implementing product development strategy, Baxter (1995) claimed that suitable personnel should be placed in a suitable position at a suitable time. Otherwise, all of the efforts expended in planning, equipment, and investment will be in vain.

A survey conducted by CEPD demonstrated that numbers of industrial designers will be unable to meet demand during the coming eight years (CEPD, 2003). Furthermore, according to CIDA (2003), the annual demand for industrial designers in the Taiwan market is about 600~800. Currently, more than 1300 industrial design graduates leave college every year. On the surface it thus seems that the supply should exceed the demand, but enterprises still claim to have difficulty in finding proper personnel (Weng, 2003). Wang (2003), creativity superintendent at BenQ, claimed that Taiwan probably produces fewer than 50 graduates per year who are qualified to take charge of practical projects. This demonstrates that despite numerous college graduates entering the job market, enterprises still have difficulty recruiting suitable industrial design personnel. On the other hand, when recruiting design personnel, managers should effectively judge the suitability of the interviewer; otherwise, managers will suffer considerable trouble when no suitable personnel can be hired.

Few studies have examined the recruitment and job performance assessment of industrial designers. However, appropriate recruitment methods are essential to designer selection and may influence

product designer job performance. This study interviewed managers of industrial design departments in local enterprises and managers of design houses to study the methods and criteria used for recruiting new industrial designers and their satisfaction with the job performance of the newly recruited industrial designers. The relationship between the method used to recruit new industrial designers and manager satisfaction with the job performance of newly recruited industrial designers was also studied. The analytical results can provide a reference for the relevant managers in selecting appropriate new industrial designers and for use in education design to create suitable curriculum and teaching contents to equip novice designers for the requirements of the job.

2. Literature review

2.1. Recruitment for industrial designers

Recruitment is a process through which an enterprise attracts individuals with suitable job knowledge and ability. Therefore, whether an enterprise can recruit high quality personnel depends on proper recruitment procedures (Werther and Davis, 1993). Appropriate and prudent recruitment will also improve enterprise image by giving the interviewers a feel of the severe attitude in hiring new personnel. DeCenzo and Robbins (1994) claimed that the recruitment procedure includes initial interview screening, completing the application form, general interview, background check, job offer, physical check, and permanent employment. Werther and Davis (1993) classified the recruitment methods used by industrial designers into written tests, interviews, and project design. Lin (2002) noted that the methods available to design houses in Taiwan for recruiting new industrial designers include face-to-face interview, portfolio check, and project design. Project design indicates tests that require interviewers to use computers, drawing sketches, rapidly process designs, and other similar tasks. Consequently, this study divided the recruitment methods used by industrial designers into four classes: written tests, face-to-face interviews, portfolio checks, and project design.

2.2. Ability and Knowledge for industrial designers

Teng (1999) and Stark et al. (1986) identified the abilities and criteria that professional designer should possess from both the theoretical and industrial perspectives (see table1).

Table 1 Criteria for professional designer

Criteria	Intension
Concept ability	Basic skills that the speciality needs to posses
Technological ability	Technological ability of foundation that professional need possesses
Ability of the background knowlege	Understanding to the society, economy and culture
Communication ability	Communicate with others through many kinds of methods
Combine ability	Combine the ability, such as concept, background knowlege, technology and communicating, in order to make effective decision
Adaptive ability	Adapt to society that improve fast, and at school professional ability learnt apply to the working practice
Professional attitude	Market competitiveness , speciality discern , the motive of professional ethics and lasting study

Additionally, during stages of product development, industrial designers should not only possess prior a detailed knowledge of design related skills but should also possess knowledge regarding marketing decisions, production, and integration and communication ability (Lin, 2002). He (1996) claimed that the primary skills for designers are creative thinking, ability to design product form, design presentation, aesthetic sense, evaluation ability and analytical ability. Yeh (2002) further observed that industrial designers should possess the following abilities: problem definition, creativity, product planning, valuation, communication and presentation, CAID skills, and independent problem solving ability. Yeh (2000) also identified the following abilities as important for industrial designers: CAID skills, problem solving, creativity, communication and coordination, knowledge of marketing strategy, international perspectives, product form design skills, mechanical and structural design abilities, ability to develop design ideas, and product planning abilities. Finally, Wang (2001) stressed

foreign language abilities and knowledge of human factors for meeting the requirements of internationalization and human factors design.

Luh (2004) and Young (2002) identified the abilities that design graduates should possess from both the theoretical and industrial perspectives. Luh and Young divided the dispositions of industrial designers into attitudes and abilities. Industrial designer attitudes can relate to teamwork, design quality, self-confidence, novelty of design, aesthetic sense, patience and perseverance. The abilities of industrial designers include creativity, keen sense of observation, awareness of design trends, idea sketch ability, verbal presentation ability, product analysis and planning ability, ability to work independently, and ability to generate proper product forms, colors and textures. From this perspective, industrial designers in an enterprise should possess numerous dispositions to be effective participants in product design and development activities. Consequently, Lin (2002) induced seven criteria for use by design houses in recruiting new industrial designers: enthusiasm, communication, desire to learn, cooperation, sketches ability, creativity, and aesthetic sense. Table 2 lists the articles of criteria for the recruitment of industrial designers.

Table 2 Articles of criteria for the recruitment of industrial designers

Article	Criteria
He (1996)	Product form design skills, Creativity, Presentation ability, Aesthetic sense, Product analysis and planning ability
Yeh (2000)	2D and 3D software ability, Design problem solving ability, Creativity ability, Product design idea presentation ability, Knowledge of marketing, Product form design skills
Wang (2001)	Software ability, Problem solving ability, Awareness of design trends, Creativity, Idea presentation ability, Knowledge of marketing, Product form design skills, Foreign language, Ergonomic knowledge
Lin (2002)	Product analysis and planning ability, Design idea presentation ability, Machining and manufacturing knowledge, Knowledge of marketing
Yeh (2002)	Problem solving ability, Presentation ability, 2D software ability, 3D software ability
Yang (2002)	Team work, Quality of design work, Self-confidence, Novelty to things, Aesthetic sense, Desire of learning, Patience and perseverance, Idea sketch ability, Product form design skills, Product analysis and planning ability, Presentation ability, Machining and manufacturing knowledge, Knowledge of marketing, Problem solving ability, Awareness of design trends, Creativity

Lin (2002)	Educational background, Work experience, Specialties, Certificates of design skills, Foreign language, Awards received, Work enthusiasm, Desire of learning
Luh (2004)	Team work, Quality of design work, Self-confidence, Novelty to things, Aesthetic sense, Desire of learning, Patience and perseverance, Idea sketch ability, Product form design skills, Product analysis and planning ability, Presentation ability, Machining and manufacturing knowledge, Problem solving ability, Awareness of design trends, Creativity

2.3. Criteria for evaluating the job performance of industrial designer

Job performance means a person can demonstrate their abilities when performing physical or mental activities (Gerhart and Milkovich, 1990). Moreover, job performance assessment describes how enterprise management record the job performance of subordinates and other related situations, and grade overall personnel performance following a certain period (Jac, 1995). Because industrial design is a highly specialized activity, it is difficult to establish standard evaluation criteria (Ulrich and Eppinger, 2000). For example, Chang and Chen (2000) claimed that in dealing with job performance assessment, the characteristics of new product development should be carefully considered and should not be processed in the same manner as production or business departments. Additionally, Cheng (1998) observed that in Taiwanese enterprises and design houses, monitoring of designer performance stresses design project output; that is primarily a sort of target management. As far as the evaluation of industrial designer's job performance is concerned, Wang (2001) mentioned seven items of job performance criteria for junior industrial designers, including product form, free hand sketching ability, personal disposition, product planning ability, knowledge of engineering and manufacturing, ability to use design software, and ergonomic knowledge. Furthermore, Lin (1997) argued that the assessment of the job performance of industrial designers relies on continuous management assessment of the job quality, efficiency, and control of the design objectives of new designers. Emphasis should be placed upon whether the newly entered designers can cooperate with other team members, their enthusiasm for work, aesthetic sense, analytical ability and creativity in solving design problems, and execution ability.

Based upon Wang's seven criteria regarding the professional ability of junior industrial designers and Lin's evaluation methods for industrial designer job performance, ten criteria were selected for evaluating the job performance of new industrial designers, as listed in Table 4.

Table 3 Criteria for evaluating the job performance of industrial designer

No	Item	Description
1	Product form	The ability in dealing with the product form, color, and texture related to the function.
2	Free hand sketching ability	The ability to present ideas with sketches quickly, clearly, and fluently.
3	Creativity	Define and solve the problem with creative thinking, an overall creative performance.
4	Personal disposition	Be aggressive and optimistic and curious about things; be able to work together as a team for design project.
5	Aesthetic sense	Be sensitive to arts, humanities, fashion, and design trends.
6	Product planning ability	Be able to solve the problem in a systematic and reasonable way.
7	Knowledge of engineering and manufacturing	Be able to process the engineering drawing for final form and model and possess knowledge of manufacturing procedure and material machining.
8	Ability to use design software	Be able to use computers for 2D graphics and layout and construct the 3D models covering product form, color, and texture.
9	Human factors knowledge	The ability to deal with 2D and 3D interface of product; be able to integrate the relations between anthropometrical data and dimensions of the product.
10	Schedule control ability	Be able to control job and schedule.

3. Method

This study used a questionnaire to explore the recruitment and job performance of new industrial designers. The primary phases of this study include literature review, questionnaire format design, survey, results analysis, and discussion. Earlier sections demonstrate that literature review covers the recruitment and criteria for selecting industrial designers and criteria for evaluating the job performance of industrial designers.

According to the above ideas from Table 2, the authors grouped the criteria used for recruiting industrial designers into three dimensions (background, professional ability, personal disposition) and 27 items (see Table 4) in the questionnaire.

Table 4 Dimensions and criteria for the recruitment of industrial designers

Dimensions	Criteria of selection
Background	(1) educational background, (2) work experience, (3) specialties, (4) certificates of design skills, (5) foreign language, (6) awards received
Professional ability	(7) idea sketch ability, (8) product form design skills, (9) product analysis and planning ability, (10) presentation ability, (11) ergonomic knowledge, (12) 2D software ability, (13) 3D software ability, (14) machining and manufacturing knowledge, (15) knowledge of marketing, (16) problem solving ability, (17) awareness of design trends, (18) creativity
Personal disposition	(19) team work, (20) quality of design work, (21) self-confidence, (22) novelty to things, (23) aesthetic sense, (24) optimistic and ambitious, (25) work enthusiasm, (26) desire of learning, (27) patience and perseverance

Based on the literature review, the questionnaire is designed to comprise four parts. The first part deals with business types and the recruitment of industrial designers in enterprises, scale of organization, and methods used for recent recruitment of industrial designers. The second part demonstrates the importance of the criteria enterprises use for recruiting new industrial designers. Three dimensions are considered: background, professional abilities, and personal disposition, each of which contains several detailed questions, for a total of 27 questions. Subjects are required to provide scores of 1, 2, 3, 4, 5 to indicate “not important at all”, “not important”, “fairly important”, “very important”, and “extremely important” in response to every question. The third part considers manager satisfaction with the job performance of new industrial designers. Ten items for evaluating job performance are product form, free hand sketch, creativity, personal disposition, aesthetic sense, product planning abilities, knowledge of engineering and manufacturing, ability to use design software, human factors knowledge, and scheduling ability. The subjects were

asked to respond with the numbers 1, 2, 3, 4, 5 to indicate whether they were "not satisfied at all", "not very satisfied", "fairly satisfied", "very satisfied", or "extremely satisfied" with the job performance of newly hired industrial designers. Finally, the subjects were asked to provide basic demographic data about themselves, including gender, age group, educational degree, and title. To ensure the validity of the questionnaire format, a pilot study was performed, and portions of the text of the survey were revised accordingly.

The survey was conducted from February to March, 2004 by mail. 91 design houses registered in CEPD and 200 enterprises from the 104 employment website (2003) that were seeking industrial designers, as well as 140 companies from the top 1000 manufacturers listed in Common Wealth (2001) that primarily produced consumption goods and information products were selected as the sample population. Managers in product design departments and those who had conducted face-to-face interviews of new industrial designers were interviewed. The newly hired industrial designers are defined as those who had obtained bachelor's degrees, and who had less than two years of work experience. Totally, 431 copies of questionnaires were sent and recalled by telephone and postcard. Finally, 93 copies valid questionnaires (21.6%) were returned. Table 5 lists the background data of the subjects.

Table 5 Statistics of the subject's background

Item	Property	No. of persons	%
Gender	Male	82	88.17
	Female	11	12.90
Age groups	25–30 years	15	16.10
	31–35 years	21	22.58
	36–40 years	31	33.33
	41–45 years	19	20.43
	46–50 years	05	05.37
	Over 51 years	02	02.15
Level of education	High school (vocational school)	02	02.15
	Junior college	15	16.12
	College	44	47.31
	Graduate school	32	34.40
Title	Person in charge of a company	18	19.35

	Department chief	37	39.78
	Creativity superintendent	17	18.27
	Senior designer	21	22.58
Business types	OEM mainly	28	30.10
	ODM mainly	28	30.10
	OBM mainly	13	13.98
	Design house	24	25.81
Organizational scale	Below 10 persons	53	56.98
	11-20 persons	36	38.70
	21-30 persons	03	03.22
	31-40 persons	00	00.00
	Over 41 persons	01	01.07

Table 6 Recruitment methods in enterprises interviewed

Recruitment methods	Design department in enterprises (64 copies)	Design house (29 copies)	*Total number (93 copies)*
Face-to-face interview	64 (100.0%)	29 (100.0%)	***93 (100.0%)***
Portfolio check	61 (95.3%)	29 (100.0%)	***90 (96.8%)***
Written test	30 (46.9%)	5 (17.2%)	***35 (37.6%)***
On the spot tests	0 (0.0%)	15 (51.7%)	***15 (16.1%)***

4. Results

4.1. Recruitment methods

Firms usually use two steps for recruiting industrial designers. Table 6 clearly shows that all firms adopted face-to-face interviews in recruiting designers, while 96.8% of them checked applicant portfolios. Additionally, 37.6% of the firms interviewed further conducted written tests, with attitude and verbal tests being required for all newly recruited employees for the personnel resource sector. Only 16.1% of the companies interviewed adopted on the-spot project design tests for ensuring the ability of newly hired industrial designers to meet the company requirements in the area of design work.

About half of design departments in enterprises (46.9%) adopted written tests, while only some design houses (17.2%) used written test.

Only some design houses (51.7%) used on the spot tests to check applicant abilities in sketching and computer-aided design and none of design departments in enterprises did.

4.2. Criteria for selecting new industrial designers

Table 7 shows that the five main criteria enterprises use for recruiting new industrial designers are, in decreasing order of importance, creativity, ability to design product form, quality of design work, awareness of design trends, and aesthetic sense; meanwhile, the five least important criteria are certificates of design skill, awards received, specialties, knowledge of marketing, and educational background.

From the overall dimension of evaluation criteria, the most important one is personal disposition, which was assigned an average score of 4.53, indicating very important, followed by professional ability in second place, with an average score of 4.33. Meanwhile, the average scores of the criteria of ability to use 2D computer software, knowledge of human factors, and knowledge of marketing fell between 3.9~3.0, indicating that they were fairly important to important. Moreover, the scores of other criteria all exceed 3.54, indicating important. For the dimension of background, the average is 3.54. The only exception was certificates of design skill, with a score of 2.92 that less than 3.00, meaning fairly important to not important, and the average scores of other criteria all fell in the range of fairly important to very important. These figures demonstrate that enterprises hope to select new industrial designers based on personal disposition, and professional ability, and ability to match project design requirements. The reason for the criteria certificate of design skill being assigned the lowest importance may be due to the lack of useful certificates of design skill for industrial designers. Therefore, the managers place little emphasis on certificates of design skill.

This study uses independent sample t test and one-way ANOVA to examine the differences among subject types and the relation between business types and criteria for selecting new industrial designers. t-test is used to examine the gender effect and ANOVA is applied to test the effects of age groups, level of education, title,

Table 7 Importance of the dimensions of criteria for selecting new industrial designers

Dimensions	Criteria of selection	Average	Std	Rank	Dimensions		
					Average	Std	Rank
Background	Educational background	3.71#	0.68	23	3.54	0.34	3
	Work experience	3.71	0.70	21			
	Specialties	3.60#	0.70	25			
	Certificates of design skill	2.92#	0.61	27			
	Foreign language	3.71	0.72	22			
	Awards received	3.57#	0.75	26			
Professional ability	Idea sketch ability	4.22	0.88	16	4.33	0.27	2
	Product form design skills	4.90*	0.31	2			
	Product analysis and planning ability	4.23	0.71	15			
	Presentation ability	4.25	0.64	14			
	Ergonomic knowledge	3.79	0.67	20			
	2D software ability	3.95	1.00	19			
	3D software ability	4.68	0.63	7			
	Machining and manufacturing knowledge	4.03	0.83	17			
	Knowledge of marketing	3.69#	0.74	24			
	Problem solving ability	4.57	0.59	10			
	Awareness of design trends	4.78*	0.43	4			
	Creativity	4.92*	0.28	1			
Personal disposition	Team work	4.56	0.65	11	4.53	0.34	1
	Quality of design work	4.84*	0.39	3			
	Self-confidence	4.01	0.75	18			
	Novelty to things	4.30	0.70	13			
	Aesthetic sense	4.74*	0.49	5			
	Optimistic and ambitious	4.38	0.62	12			
	Work enthusiasm	4.61	0.58	9			
	Desire of learning	4.70	0.48	6			
	Patience and perseverance	4.61	0.61	8			

Note: "*" means importance ranked in top 5 and "#" denotes importance ranked in

business types, and organizational scale. The F values and P values demonstrate whether significant differences exist among these criteria. Furthermore, the Scheffé multiple comparison test is applied to different groups to identify the causes for these significant differences (McCall, 1998). Criteria, property of enterprises, and criteria that reach significant differences are shown in Table 8.

Regarding the titles of interviewed subjects, enterprise department chiefs, creativity managers, and senior designers place greater emphasis on the foreign language competence of new industrial designer than managers in charge of design houses do. This phenomenon demonstrates that design departments in enterprises place a greater emphasis on internationalization and designing products for global markets than design house managers do.

Regarding level of education, managers with higher educational backgrounds are more concerned with about the product form design ability and idea sketch ability, while lower educational backgrounds are concerned with the machining knowledge, meaning that managers with higher educational backgrounds ask more about design skills of the newly hired industrial designers.

Regarding gender, male managers tend to emphasize the 3D software abilities of prospective new designers more than female managers do, while female manages emphasize creativity. It indicates that male managers may focus on design techniques, while female managers focus on creativity when recruiting new designers.

In terms of age groups, older managers tend to place a greater emphasis on the 2D software abilities of designers, as well as marketing knowledge, demonstrating that older managers may ask new industrial designers to use 2D graphics for displaying product ideas and are highly concerned with ideas that relate to special marketing strategies.

In terms of business types, managers in enterprises that aggressively design and develop new products, that is, ODM, and OBM business types, and managers in design houses, place greater emphasis on the sketching and team work abilities of new designers than mangers in OEM business types do. It indicates that managers in different types of enterprises will seek different design abilities in newly recruited industrial designers. Regarding organization scale, managers

Table 8 Criteria, property of enterprises, and criteria that reach significant differences

Criteria	Property	Average & ANOVA for recruitment methods	t or F value	P value
Foreign language	Title	Department chief (3.95)>manager in charge of design house (3.28); Creativity superintendent (3.71)>Person in charge of design house (3.28); Senior designer (3.62)>Person in charge of design house (3.28)	3.77	0.016*
Idea sketch ability	Level of education	Graduate school (4.38)>Junior college (3.33); College (4.16)>Junior college (3.33)	4.93	0.003*
	Business types	ODM (4.25)>OEM (3.54); OBM (4.69)>OEM (3.54); Design house (4.25)>OEM (3.54)	6.64	0.000*
	Organizational scales	11~20 persons (4.47)> below 10 persons (3.79)	5.11	0.003*
Product form design skills	Level of education	Graduate school (4.91)>High school (4.00); College (4.86)>High school (4.00); Junior college (4.93)>High school (4.00)	4.43	0.006*
2D software ability	Age groups	41~45 years (4.53)>26~30 years (3.60); 41~45 years (4.53)>31~35 years (3.71); Over 51 years (3.50)>26~30 years (3.60)	2.47	0.038*
3D software ability	Gender	Male (4.71)>Female (4.27)	2.12	0.037*
Machining knowledge	Level of education	Junior college (4.53)>college (3.91)	2.85	0.042*
Knowledge of marketing	Age groups	46~50 years (4.20)>31~35 years (3.29); Over 51years (3.50)>31~35 years (3.29)	2.53	0.034*
Creativity	Gender	Female (5.00)>Male (4.89)	3.16	0.002*
Team work	Business types	Design house (4.79)>OEM (4.25)	3.37	0.022*
	Organizational scales	11~20 persons (4.78)> below 10 persons (4.38)	3.65	0.016*

Notes: "*" represents reaching significance level of 0.05.

in enterprises with large numbers of employees place greater emphasis on the sketch ability and team work of new industrial designers, meaning that managers in different sized organizations require different team work abilities from newly hired industrial designers.

4.3. Job performance

Table 9 lists the overall situation of the job performance of newly recruited industrial designers. The overall average job performance score for new industrial designers is 3.66, falling in the range between fairly satisfied and very satisfied. This score indicates that managers are not extremely satisfied with the performance of newly hired industrial designers. Among job performance items, the top three criteria associated with higher levels of manager satisfaction are schedule control ability, aesthetic sense, and computer aided design software manipulating ability. Meanwhile, the criteria that managers are least satisfied with are free hand sketching, knowledge of engineering and manufacturing, and product planning abilities. This phenomenon exists because industrial designers are good at using computer software to assist in developing project proposals. These tools can reinforce product design efficiency, but may lead newly recruited industrial designers to neglect traditional free hand sketch skills. Additionally, considerable variety exists in the application of product texture and machining techniques. Newly recruited industrial designers should enrich their knowledge of engineering and manufacturing. It is also the case for product planning ability, and thus newly recruited industrial designers should strengthen their product planning ability.

Furthermore, table 10 lists the effects of different recruitment methods on industrial designer job performance. Face-to-face interview is indispensable for all recruitment methods. Therefore, a t-test is conducted to analyze the effects of portfolio check, project design, and written test. The test result demonstrates that portfolio checking significantly influences the performance of new industrial designers in terms of creativity, personal disposition, and schedule control ability. This phenomenon occurs because a portfolio often indicates designers work experience, sketches, and similar information which managers can use as a basis for selecting individuals with better work experience

and execution ability. Furthermore, the adoption of project design also leads to significant differences in the performance of new industrial designers in terms of product form skills, product planning abilities, and ability to use design software. In the procedure of the project design test, the manager frequently asks designers to perform practical design tasks such as idea sketches, rapid design, and computer graphics, so that the manager can select designers with better design ability who are better able to cope with work pressure. Finally, the written test also causes significant differences in the personal disposition of industrial designer. This phenomenon occurs because the result of attitude testing will reflect whether the personal disposition or character of the new industrial designer is suitable for product design.

Table 9 Descriptive analysis of the industrial designers' job performance

Item of job performance	Average	Std	Rank
Product form	3.92	0.97	1
Aesthetic sense	3.92	0.77	2
Ability to use design software	3.81	0.90	3
Personal disposition	3.76	0.82	4
Creativity	3.74	0.76	5
Product form	3.69	0.84	6
Ergonomic knowledge	3.57	0.68	7
Product planning ability	3.57	0.79	8
Knowledge of engineering and manufacturing	3.44	0.94	9
Free hand sketching ability	3.20	0.85	10
Total average	3.66	0.50	--

Table 10 The items of industrial designer's job performance that recruitment methods' effect reaches significant levels

Job performance	ANOVA for recruitment methods	t-value	P value
Product form	project design (3.78)>no project design (3.11)	4.61	0.001*
Creativity	portfolio check (3.96)> no portfolio check (3.69)	2.20	0.028*
Personal disposition	written test (3.86)> no written test (3.62)	2.38	0.018*
	portfolio check (3.98)> no portfolio check (3.71)	2.58	0.040*
Product planning ability	project design (3.62)> no project design (3.22)	2.83	0.005*

Ability to use design software	project design (3.85)> no project design (3.50)	2.22	0.028*
Schedule control ability	portfolio check (4.15)> no portfolio check (3.88)	2.32	0.023*
Average	portfolio check (3.80)> no portfolio check (3.63)	2.90	0.004*
	project design (3.70)> no project design (3.40)	2.72	0.009*

Notes: "*" represents reaching significance level of 0.05.

5. Discussions and suggestions

This study explored the methods and data used to recruit new industrial designers and their satisfaction with the job performance of newly recruited industrial designers. The relationship between the method used for recruiting new industrial designers and manager satisfaction with the job performance of newly recruited industrial designers was also explored. The survey results can provide a reference for managers, educators, and designers. The author reached the following conclusions.

(1) Besides the fact that all firms adopted face-to-face interviews in recruiting designers, 96.8% of them checked applicant portfolios. Additionally, 37.6% of the firms interviewed further by conducting written tests, with attitude and verbal tests being required for all newly recruited employees for the personnel resource sector. Only 16.1% of the companies interviewed adopted on the spot project design tests for ensuring the ability of newly hired industrial designers to meet the company requirements in the area of design work. About half of design departments in enterprises (46.9%) adopted written tests, while only some design houses (17.2%) used a written test. Only some design houses (51.7%) used on the spot tests to check applicant abilities in sketching and computer-aided design, and none of design departments in enterprises did.

(2) The five most important criteria in recruiting new industrial designers are creativity, product form design ability, design quality, awareness of design trends, and aesthetic sense; meanwhile, the five least important criteria are certificates of design skill, awards received,

specialties, knowledge of marketing, and educational background. Selection criteria differ significantly among managers with different backgrounds, firm scales and business types. As a result, industrial designers should improve their personal dispositions, such as teamwork, self-confidence, optimism, aggression, enthusiasm and their professional abilities to meet an enterprise's requirements.

(3) There exist significant differences in the property of enterprises and criteria. In terms of the titles of interviewed subjects: enterprise department chiefs, creativity managers, and senior designers place greater emphasis on the foreign language competence of new industrial designer than do managers in charge of design houses. In terms of level of education, managers with higher educational backgrounds are more concerned about the product form design ability and idea sketch ability, while lower educational backgrounds are concerned with the machining knowledge. In terms of gender, male managers tend to emphasize the 3D software abilities of prospective new designers more than female managers do, while female manages emphasize creativity. In terms of age groups, older managers tend to place a greater emphasis on the 2D software abilities of designers, as well as marketing knowledge. In terms of business types, managers in enterprises that aggressively design and develop new products, that is ODM and OBM business types, and managers in design houses, place greater emphasis on the sketching and team work abilities of new designers than do mangers in OEM business types. In terms of organization scale, managers in enterprises with large numbers of employees place greater emphasis on the sketch ability and team work of new industrial designers.

(4) Enterprise managers are not very satisfied with the job performance of newly hired industrial designers. The three items used to assess the performance of newly recruited industrial designers that managers are most satisfied with are schedule control ability, aesthetic sense, and ability to use design software; meanwhile, the three items that managers are least satisfied with are free hand sketching, knowledge of engineering and manufacturing, and product planning abilities. The field of design education should focus on these items and organize an appropriate curriculum to cultivate designers that will be more competitive in the human resource market.

(5) The written test causes significant differences in the personal dispositions of new industrial designer. On the spot design testing causes significant differences in the abilities of new industrial designers in product forming, product planning, and using design software. Consequently, depending on requirements, enterprise managers can adopt specific recruitment methods of combinations of different procedures for more effectively hiring excellent design talents.

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