The Influence of Humanities on Art and Design Learning Performance: An Empirical Study

Qizhang Sun, Zhaolin Lu and Xipei Ren

Abstract

Theoretical studies and perspectives have argued that humanities positively influence art and design learning performance, yet little study has tested this argument empirically. Further than testing the impact of humanities on art and design learning performance, the present study explores how humanities influence art and design learning performance. The present study investigates the influence of humanistic knowledge (e.g., history and literature) and skills, capabilities (e.g., innovation and narrative) and spirits on art and design learning performance (e.g., professional course marks) empirically via a survey. The moderations of age and gender are also tested. The results showed that humanistic knowledge and skills and humanistic spirits increase the art and design learning performance of visual communication and industrial design students, respectively. Humanistic capabilities increase art and design learning performance for all subjects. Besides, we found the individual difference that the effects of humanistic capabilities and humanistic spirits are stronger in male visual communication students than in female visual communication students. The pedagogical strategy of humanistic education for improving art and design learning is discussed based on the results.

Keywords

art and design education, humanistic capabilities, humanistic knowledge and skills, humanistic spirits, pedagogical strategy

Introduction

Alongside the technology growth, interdisciplinary education, especially interacting with science and technology, has raised education practitioners' attention. However, humanities still play an irreplaceable role in education. A large-scale survey across four countries showed that critical thinking does not progress and even

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degenerates for students with fewer courses in humanities and social sciences (Loyalka et al., 2021). Scientific disciplinaries, such as medical education, emphasise the value of humanities and have promoted humanities education for years (Ousager & Johannessen 2010). Most countries' education policies also underline the special position of humanities. In addition to the liberal art education in Western countries, the Minster of Education in China recently published "Guidelines for Public Art Courses in Colleges and Universities". Art and design are rooted in humanities, and humanities support science and technology learning. However, art and design education gradually lose its focus on humanities and requires more attention (Coleman 2010). the proportion of technical and technology-oriented skills, such as computer-aided design and drawing, programming and parametric design, has risen in the art and design education curriculum, squeezing the space for humanities education (Coleman 2010). One potential reason art and design lose focus on humanities education is that the outcomes of humanities education are not illustrated as technology. Previous studies provided evidence from other design-related disciplines (e.g., engineering; Josa & Aguado 2021), theoretical perspectives and studies (e.g., Coleman 2010), and empirical evidence for the liberal art experience on liberal art learning outcomes (Seifert *et al.* 2008). Nevertheless, the significance of humanities to art and design education is surprisingly endorsed by little direct empirical evidence. Hence, demonstrating the outcomes of humanities education in art and design education is critical to bring back attention to humanities education. Therefore, the present study's primary purpose is to demonstrate whether humanities influence art and design learning performance empirically.

As technology grows, interdisciplinary education thrives. The point that design programs should blend elements of humanities with technological ones has been raised for many years since the early stage of the information age (Owen 1990). Further than answering a question about 'whether', the more important question is 'how'. More specifically, it is unbeknownst in what way humanities benefit art and design education in the context of the information age. Hence, the present study also explores how humanities influence art and design learning performance.

The present study investigates the two research questions using a Chinese sample because Chinese art and design education is an ideal representative of the studied subject. In China, 'Xin Wenke' was proposed in 2018 and has been implemented for years to strongly support the higher education system. 'Wenke' combines social sciences and humanities (Kang 2018). Similar but distinguished from liberal art, 'Wenke' uses methods and logic of science through the lens of humanism but with the absence of 'science'. 'Xin Wenke' in Chinese means the new 'Wenke', a disciplinary development focusing on blending elements of science and technology into 'Wenke'. This concept is similar to 'STEAM'. However, 'STEAM' emphasises combining science, technology, engineering, art and mathematics rather than combining other disciplines, especially science and technology, into art and design. Besides, 'STEAM' is an educational concept for K-12 education, while 'Xin Wenke' is for higher education. The other reason for using a Chinese sample is that as the second largest economic entity, China strongly connects to the world and reflects in the art and design industry. Following the industrial impact, China also starts to have its impact on art and design education. Chinese art and design and art and design education research are published more internationally than nationally and play a significant role internationally (Buchanan 2004). Hence,

studying humanities' impact on art and design learning performance in the interdisciplinary education context using a Chinese sample is significant.

The influencing factors of humanities on art and design education

Following the previous study on the impact of humanities on Chinese medical students (He 2019), humanities are decomposed into three components: humanistic knowledge and skills, humanistic capabilities and humanistic spirits. This section reviews and summarises the potential influence of these humanities components on art and design education.

Traditional humanities education focuses on humanistic spirits, such as empathy, respect and responsibility (He 2019). These parts of humanities, i.e., ethical and social education, are argued to be beneficial to art and design education (Buchanan 2004). Many theoretical studies that support the positive influence of humanities on art and design learning performance are based on this perspective of humanities. Hence, we hypothesize that:

H1. *humanistic spirits increase art and design learning performance*

In addition to the traditional humanities education content, "Xin Wenke" extends the meaning of humanities to leadership, innovation, narrative, self-regulation, cooperation, learning and coordination, referred to as humanistic capabilities (He 2019). This humanities category is included in liberal arts education but distinguished from liberal arts that exclude natural science such as geometry and astronomy. Researchers in multiple arts and design disciplinaries suggest including these humanistic capabilities in the art and design study program (e.g., ICSID 2003; Yang *et al*. 2005; Cartier 2011; Chiang 2018), as which are critical to art and design practitioners and researchers (McCoy 1990; Buchanan 2001; Swanson 2004; Lasky 2005; Baseman 2015; Davis 2015; Giampietro 2015; Walker 2017) and are promoted by traditional humanities (Dumitru 2019; Ghias *et al*. 2020). Although perspectives and theoretical studies have argued that humanistic capabilities increase art and design learning performance, little evidence supports this argument to our best knowledge. An exemption is a study investigating the influence of visuospatial ability (Acar & Soysal Acar 2020). Although cognitive ability is related, this concept is not exactly identified as humanistic capabilities. Besides, this study was for a specific subject, i.e., first-year architecture students. Given the theoretical studies mentioned above, we hypothesize that:

H2. *humanistic capabilities increase art and design learning performance*

Although the present study focuses on humanities rather than skills, art-based skills (such as aesthetic and instrument performance) are widely accepted as a part of humanities. These skills are expected to link to individuals' aesthetic performance, which might sequentially influence the art and design learning performance. On a separate note, social and humanities-related knowledge is usually acquired from reading, such as history and literature, and is defined as humanistic knowledge in the present study. This knowledge is expected in high demands for art and design education because artists and designers usually work under a broad range of specific contexts, which requires awareness of the social and economic environment (Cheung 2016; Chiang 2018) and broader knowledge outside the profession

domain (Buchanan 2001). Given the art and design demands on this social and domain knowledge, we hypothesize that:

H3. *humanistic knowledge and skills increase art and design learning performance*

Individual differences

Further than examining the association between humanities and art and design learning, we also expect gender and age differences in this association. Trusz (2020) demonstrated that females prefer humanities and social studies while males prefer technology and science. The researcher argued that females' and males' selections were influenced by teachers' expectations and self-concept, respectively. This result suggests that females are more sensitive to the humanistic context. Hence, we expect this humanistic sensitivity for females to boost the effect of humanities on art and design study performance. Besides, evidence from medical education also supported this hypothesis and showed that specific to critical-thinking females perform better than males (Ghazivakili *et al*. 2014). Hence, we hypothesize that:

H4. *Gender moderates the influence of humanities education on art and design learning performance*

In addition to gender differences, we also expect age differences. As individuals grow, they have more experience and knowledge in their major, which might further increase the effect of humanities on art and design study performance. Indeed, Cartier (2011) found that first-year industrial design students and fourth-year industrial design students have different expectations of the curriculum. Specifically, the first-year students have inconsistent expectations and give importance to aesthetic value, while the fourth-year students consistently expect to learn the methods of generating creativity. These differences suggest that the impact of humanities on art and design learning might vary among young students. Alongside aging, the impact of humilities, including creativity, sheds light on their professional learning. However, evidence from medical education showed that age is negatively associated with critical thinking (Ghazivakili *et al*. 2014). Hence, we hypothesize that:

H5. *Age moderates the influence of humanities education on art and design learning performance*

Method

Participants

Five hundred and fifty-one students in the School of Design and Art participated in the study voluntarily (Female: 413, Male: 137, Other: 3; M_{age}: 21.96, SD_{age}: 2.54). We distributed our survey on Questionnaire Star (i.e., a popular survey platform in China) via a Wechat (i.e., a Chinese immediate communication mobile application) group by the group's administrator. The Wechat group is served for official announcements from the university. Students in the group could select the link to participate in the study. All the participants in the study consented and agreed to share their anonymous data. Table 1 shows the distribution of the number of participants.

TABLE 1 The number of participants in different majors and grades

Major/Grade	Undergrades20	Undergrades19	Undergrades18	Undergrades17	Masters	PhD	Total
Industrial design	16	15	24	2	107	6	170
Product design	33	16	41	1	2	0	93
Visual communication	34	12	23	2	31	0	102
Environmental Art	27	17	23	2	60	1	130
Plastic arts	0	0	1	0	5	0	6
Cultural heritage	11	13	3	1	9	1	38
Traditional arts and crafts	0	0	0	0	7	0	7
Art theory	0	0	0	0	2	3	5
Total	121	73	115	8	223	11	551

Procedure

After landing on the survey, participants were asked to consent to the study and the unidentified data sharing. If participants agreed to participate in the study and share the anonymous data, they were asked to select their range of weighted average marks and complete a series of demographic questions, such as major (industrial design, product design, visual communication, environmental art, plastic arts, cultural heritage, traditional arts and crafts or art theory), grade (undergraduates 2020, 2019, 2018, 2017, masters students or doctoral students), gender, original of place, age and whether they have siblings. Participants answered questions about humanities measurement in the next two pages before completing the survey. We conducted two pilot studies to validate the survey. At the end of the pilot studies, we provided a space for qualitative feedback.

Measurements

The measurement in our study includes two parts: the weighted average mark of the students and humanities measurements. Regarding humanities measurements, previous studies had inconsistent measurement categories. Most empirical studies measured knowledge and skills, i.e., exposure to art, literature, music et al. (e.g., Mangione *et al*. 2018; He 2019; Petrou *et al*. 2021). Other studies (e.g., He 2019) also measures capabilities (e.g., creativity, critical thinking and communications) and spirits (i.e., the traditional humanities). To fully measure humanities, we include all major categories from literature, i.e., knowledge and skills, capabilities and spirits.

Weighted average mark (mark)

The mark in our study was accessed by self-report. Following the grading system in China, the mark was an average mark weighted by course credits. The full mark and pass in the Chinese education system are 100 and 60, respectively. Participants were asked to report their marks for university studies until now. According

to the feedback from the pilot study, participants could not record their marks precisely. Hence, instead of reporting a precise mark, we asked participants to select one of the following ranges of mark: (1) 0–64.99, (2) 65–74.99, (3) 75–84.99, (4) 85–94.99 and (5) 95–100. The mark range category followed the university's recommending system rule. This recommending system is part of the postgraduate application system that allows whom reach a certain range of marks to be waived from the entrance exam and directly enrol in the graduate course.

Humanistic knowledge and skills

The humanistic knowledge survey in our study was adjusted from previous studies on medical students' humanistic knowledge measurement (Mangione *et al*. 2018; Petrou *et al*. 2021). The humanistic knowledge measurement measured how many hours participants spent reading and watching material about history and literature and participating in or practising vocal art and performing art per week (Appendix A). Compared to the previous studies on medical students (Mangione *et al*. 2018; Petrou *et al*. 2021), we excluded the measurement of participating or practising visual art because all participants have professional training. The professional training has a significantly higher baseline than other humanities skills, potentially biasing the average level of the humanities skills.

Humanistic capabilities and spirits

The humanistic capabilities survey in our study included leadership, innovation, narrative, self-regulation, co-operation, learning and coordination. The humanistic spirits in our study included empathy, respect, and responsibility. These measured aspects of humanistic capabilities and spirits were based on a previous study researching medical students' humanistic capabilities and spirits measurement specific to Chinese students (He 2019). As the original questions were designed for medical students, some of the questions were adjusted from the original survey for medical students to the survey for design and art students by discussing three experts (i.e., university faculty members) in art and design. Participants answered on a 5-point Likert scale from strongly disagree to strongly agree with the opinions on the survey (Appendix A).

Results

Before investigating the influence of humanities, we first explore the reliability of the survey and the state quo of humanities data. The Cronbach's alpha of the questionnaire is 0.922, and the bootstrap 95% confidence interval based on 1000 samples is [0.912, 0.929]. This result suggests that the reliability of the survey is excellent. Figure 1 demonstrates that the humanistic capabilities and humanistic spirits scores for visual communication and plastic arts students are lower than average, while environmental arts students are above average. Industrial design students' humanistic knowledge and skills scores are lower than average, while product design and visual communication are higher than average. Further analysis with linear regression predicting humanistic components by age across subjects illustrated that humanistic knowledge and skills slightly drop alongside growing age (β = -0.03, p = 0.049). In contrast, humanistic capabilities increase alongside growing age (β = 0.03, p = 0.001).

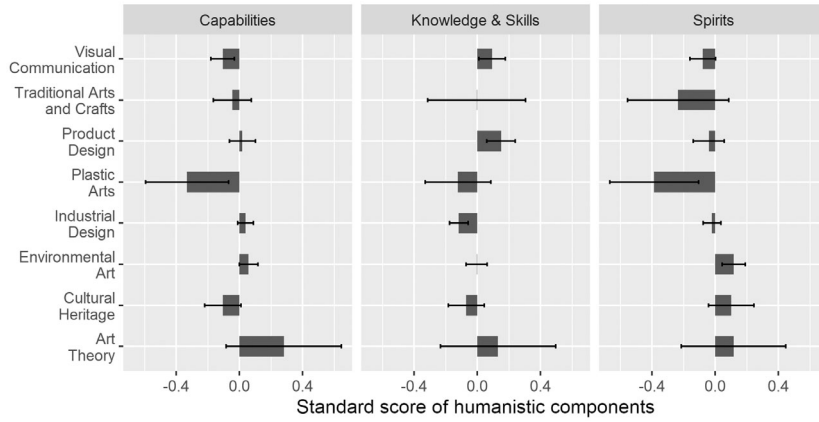

Figure 1
Descriptive Overview of Humanities for All Subjects. Error Bars Stand for Standard Error

To understand the influence of humanities on students' marks, for each humanistic component, we run ordinal logistic regressions predicting marks by a humanistic component for industrial design, product design, visual communication, and environmental art, respectively. Running individual models for different majors is because students have different courses with different curricula and grading standards, which are incomparable. We also exclude the models for plastic arts, cultural heritage, traditional arts and crafts, and art theory because of the insufficient sample size for these majors (see Table 1 for the sample size of different majors). All the analytical models are calculated by the statistic program 'R' with the 'lrm' function in the 'rms' package.

The effect of humanistic knowledge and skills, as well as its moderation

The rating for humanistic knowledge and skills in this model is a standard score centered on group mean and using standard deviation as a unit, i.e., the difference between individual rates and mean of the rates for the question in the survey divided by the standard deviation of the rates for the question in the survey. Standardising the rating for humanistic knowledge and skills is because the scale for different items (i.e., questions in the survey) is inconsistent. For example, people can read literature daily for several hours but only go to concerts a few times yearly for 2 and 3 h per concert.

As Figure 2 shows, humanistic knowledge and skills positively correlate with visual communication students' marks (*odds ratio* = 1.65, p = 0.042) but not the other three majors. This result is partially consistent with our hypothesis (see full results in Appendix B). A remarkable result to be highlighted is that the effect size (i.e., odds ratio) increases alongside the mark range decreasing (Appendix B). Further analyses for the moderation of age and gender do not show any significant effect.

The effect of humanistic capabilities and its moderation

Regarding the effect of humanistic capabilities on learning performance, Figure 3 shows that students with higher humanistic capabilities scores are more likely to

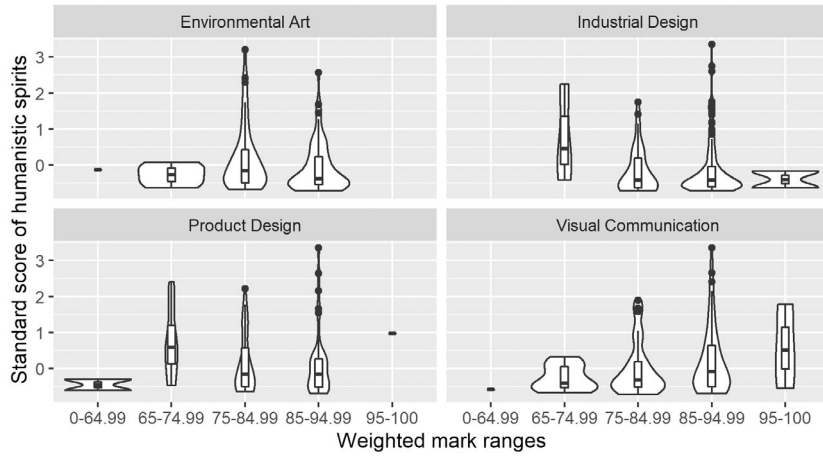

Figure 2
The Effect of Humanistic Knowledge and Skills on the Mark

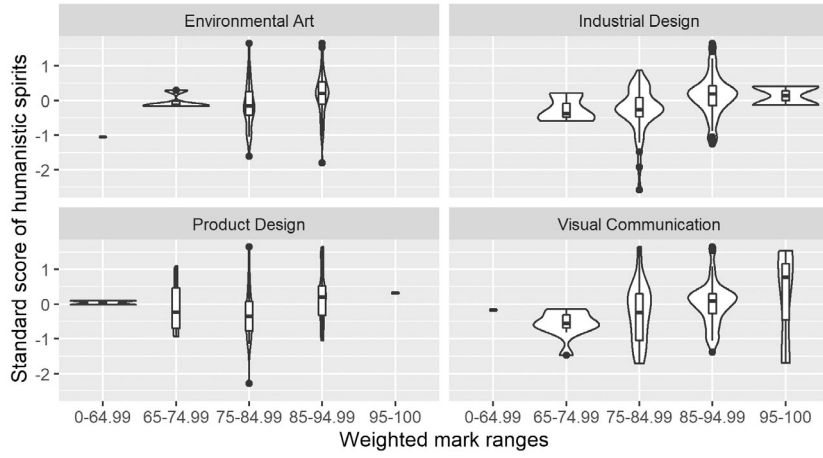

Figure 3
The Effect of Humanistic Capabilities on the Mark

receive a higher grade. This effect applies to students who major in industrial design (*odds ratio* = 3.98, $p < 0.001$), product design (*odds ratio* = 2.43, $p = 0.014$), visual communication (*odds ratio* = 2.58, $p = 0.010$), and environmental art (*odds ratio* = 2.98, $p = 0.006$), which is in line with our hypothesis (see full results in Appendix C). Besides, the effect size (i.e., odds ratio) increases alongside the mark range decreasing.

By further testing age moderation, we did not observe that age moderates the effect of humanistic capabilities on marks. Still, we found a gender difference among the students in visual communication. Specifically, Figure 4 shows that for visual communication students, the probability of increasing the mark by raising the humanistic capabilities level for male students is 11.11 times as for female students ($p = 0.025$). This gender moderation, nevertheless, does not apply to the other three majors. This result is opposite to our hypothesis.

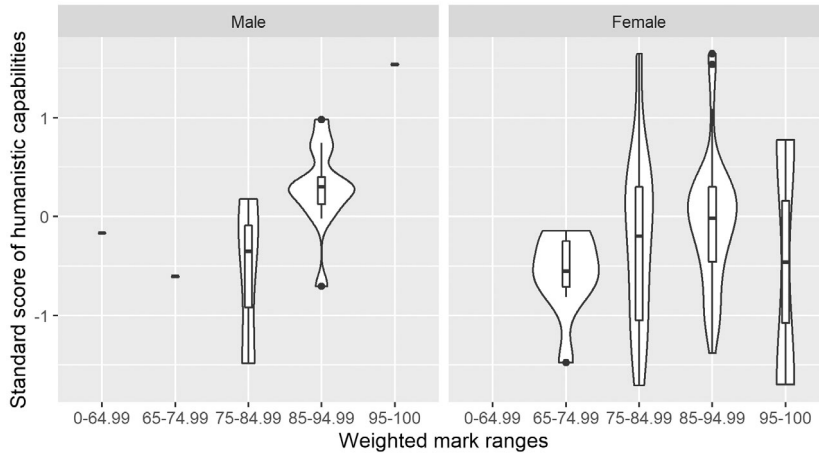

Figure 4
Boxplot and Violin Plot for the Moderation of Gender on the Effect of Humanistic Capabilities in Visual Communication

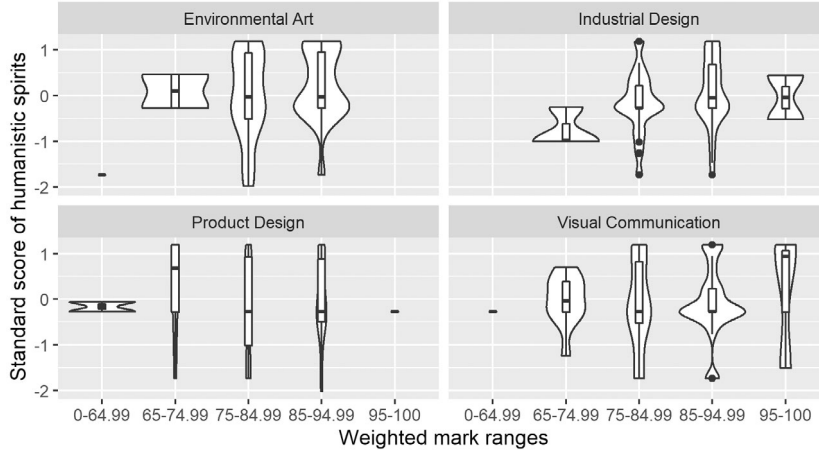

Figure 5
The Effect of Humanistic Spirits on the Mark

The effect of humanistic spirits its moderation

Regarding the effect of humanistic spirits on learning performance, Figure 5 shows that students with higher humanistic capabilities scores are more likely to receive a higher grade. However, this effect is only significant for industrial design students (*odds ratio* = 1.98, $p = 0.047$) but not for the other three majors, which is only partially in line with our hypothesis (see full results in Appendix D). A remarkable result to be highlighted is that the effect size (i.e., odds ratio) increases alongside the mark range decreasing (Appendix D).

By further testing age moderation, we did not observe that age moderates the effect of humanistic spirits on marks. Still, we found a gender difference again for the students in visual communication. Specifically, Figure 6 shows that for visual

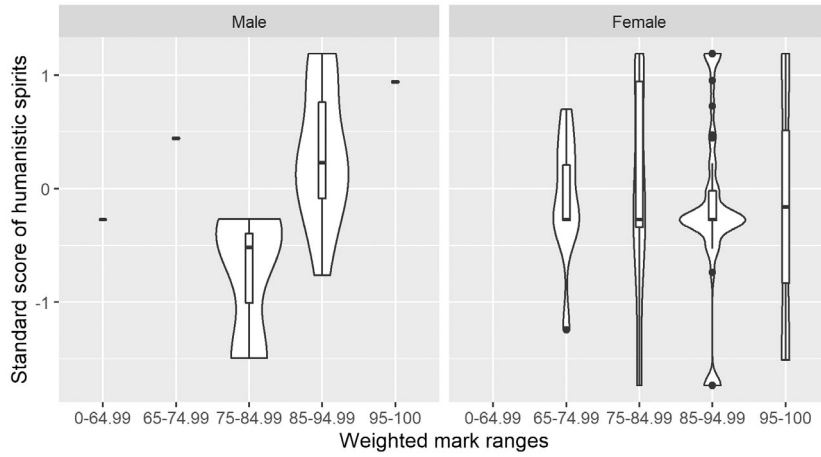

Figure 6
Boxplot and Violin Plot for the Moderation of Gender on the Effect of Humanistic Spirits in Visual Communication

communication students, the probability of increasing the mark by raising the humanistic spirits level for male students is 10 times as for female students ($p = 0.03$). This gender moderation, nevertheless, does not apply to the other three majors. This result is opposite to our hypothesis.

Discussion

The present study investigated the impact of humanistic knowledge and skills, humanistic capabilities, and humanistic spirits on art and design learning performance in China. The results generally illustrated that humanistic knowledge and skills and humanistic spirits increase visual communication and industrial design learning performance, respectively. Humanistic capabilities greatly affect learning performance for all subjects. We especially observed gender differences in the influence of humanistic capabilities and humanistic spirits for visual communication students, where the effect is stronger for males than females.

Remarkable insights

One remarkable insight provided by the present study is the humanistic education strategy. The results show that humanistic capabilities increase art and design learning performance for all students. Hence, one remarkable insight is that all students should strengthen their humanistic capabilities to increase their art and design learning performance. However, the impact of humanistic knowledge and skills and humanistic spirits increase alongside the mark range decreasing. This result implies that the humanistic education strategy should depend on students' learning performance. As humanistic knowledge and skills and humanistic spirits are most beneficial to the students with difficulty in art and design learning, students with difficulty in art and design learning should have more humanistic knowledge, skills, and spirits education than those at the top tip.

Previous studies suggested pedagogical strategies to improve liberal art education for design education and industrial design education. These insights are valuable references to humanistic education because humanities are important elements of liberal art education. In general design education, researchers suggested that active methods developed in groups and exchange milieus can assist students in improving liberal art education outcomes, especially with a constructivist approach and collaborative practices (Nazaré de Freitas & Assoreira-Almendra, 2022). In industrial design, researchers suggested pedagogical methods changing from one-on-one to peer-to-peer teaching and learning and identity change from a studio master to a learning guide (Feast 2020). These pedagogical strategies are also encouraged to practice in humanistic education to improve students' humanistic capabilities and spirits.

Interpretations for unexpected results

In the present study, we did not observe a significant general impact of humanistic knowledge and skills and humanistic spirits on students' art and design learning performance, which contradicts our hypotheses. The following reasons potentially cause this result.

For humanistic knowledge and skills, three reasons potentially cause this result. First of all, although most artworks and designs require awareness of the social and economic environment (Cheung 2016; Chiang 2018) and broader knowledge outside the profession domain (Buchanan 2001), this circumstance usually exists in the industry, where especially among artists or designers face specific requests from clients. In contrast, students can select the objects for most courses works. Although the choices are limited to specific domains and courses, teachers usually select the topics that students are familiar with, and students still have more space to select their design or artwork object than industrial practitioners. In this case, knowledge and skills are not required to have an ideal mark. Another reason is that these skills are not directly beneficial to their study but are transferable skills that help their career in the future. In this case, the effect is not immediately shown on the course marks. The third reason is that aesthetic skills are an important part of humanistic skills, but they are excluded from the survey as they are in the professional training program. Hence, it might bias the result.

For humanistic spirits, although only the effect on industrial design is significant, the effect sizes of all subjects are similar and positive (C). Hence, humanistic spirits generally affect art and design learning performance little. The potential reason is similar to the humanistic knowledge and skills, which is the salience of humanistic spirits on art and design outputs requiring a longer time to present.

Gender difference

Regarding gender difference, we found that the effect of humanistic capabilities and humanistic spirits on visual communication students is stronger for males than females, which is opposite to our hypothesis. This result might be biased. Figure 4 and Figure 6 show that male visual communication students' marks gathered in the middle range and missed the tails on the high and low end. In this case, the trend is too sensitive to detect an effect.

Conclusion

The present study empirically tested the influence of humanities on art and design learning performance. The most significant finding is that humanistic capabilities, such as leadership, innovation, narrative, self-regulation, cooperation, learning, and coordination, largely increase art and design learning performance. The present study also provides a remarkable insight into pedagogical strategy in art and design education, i.e., to raise art and design learning performance, educators should (1) fill students who have difficulty in art and design learning with humanistic knowledge and skills and humanistic spirits and (2) fill all students with humanistic capabilities.

The significance of the present study is fourfold. In the information age, the most current curriculum focuses on skill training. Many studies argue the humanities impact art and design learning, yet little empirical evidence has been provided. The present study provides the humanities' impact empirically. The present study further encourages art and design educators in higher education to pay much more attention to humanities and increase humanities education proportion in the curriculum. Moreover, although most of the curriculum is with some humanities education, humanistic capabilities are not included in the traditional humanities education category. The present study highlights the critical point of humanistic education. Further than showing humanities education's impact, the present study demonstrates how humanities influence art and design learning performance and sequentially suggests a pedagogical strategy. Another significance of the present study is that the present study investigates humanistic education in Chinese art and design education, which has unignorable power on international art and design.

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Appendix A: Questionaire (the section title in block was not shown to the participants)

Demographics (question types in brackets were not shown to the participants)

- Major (dropdown list)
- Grade (dropdown list)
- Gender (multiple choice)
- Birthplace (dropdown list by province and city)
- Age (filling in from 16 to 99)
- Only child (multiple choice)
- Weighted average score range since enrollment (dropdown list)

Note: *Weighted Average Score=Course 1 Score x Course 1 Credits/Total Credits+-Course 2 Score x Course 2 Credits/Total Credits+...*

Knowledge and Skills (slide in percentage; next page)

Please select the average time (in hours) you have participated in the following activities per week

- Watch, read or listen to information about ancient China historical materials (traditional media such as books and newspapers and digital media such as WeChat subscriptions and videos)
- Watch, read or listen to information about China's modern and contemporary history (traditional media such as books and newspapers, and digital media such as WeChat subscriptions and videos)
- Watch, read or listen to information about ancient Western history (traditional media such as books and newspapers and digital media such as WeChat subscriptions and videos)
- Watch, read or listen to information about modern Western history (traditional media such as books and newspapers and digital media such as WeChat subscriptions and videos)
- Reading or listening to literature (such as prose, novels and poetry)
- Writing literature (such as prose, novels and poetry)
- Literature analysis
- Participate in vocal art activities (such as listening to concerts, concerts, etc.)
- Practice or perform vocal art (such as singing, playing instruments, etc.)
- Create vocal artworks (such as singing repertoire, performance repertoire, etc.)
- Reading vocal art theory (such as singing technique theory, vocal theory, etc.)
- Participate in performing arts activities (such as watching dance, drama, drama, opera, etc.)
- Practice or perform performing arts (such as dance, drama, drama, opera, etc.)

- Create performing arts works (such as dance, drama, drama, opera, etc.)
- Reading performance art theories (such as dance, drama, drama, opera, etc.)

Please choose your level of agreement with the following views (next page)

Capabilities (five-point scale on strongly disagree, disagree, neutral, agree, and strongly agree)

- I can be a leader in collaboration
- I can use methods that teachers and classmates think are very innovative
- I can propose a viewpoint that the teacher and classmates think is very novel
- I can organise scattered information into a complete event
- I can narrate clearly and logically
- I can cope with external distractions (such as partners' understanding deficiency, clients' demands, etc.)
- I can cope with internal interference (such as emotional issues, stress, etc.)
- I can cooperate with others happily
- I can collaborate with others efficiently

Spirits (5-point scale on strongly disagree, disagree, neutral, agree and strongly agree; next page)

- I learn deficient knowledge actively.
- I communicate with others proactively when encountering problems in collaboration.
- I can co-ordinate conflicts between collaborators.
- I can listen and understand others' feelings, and I care and help others actively.
- I can respect ideas that are different from mine
- I do not actively pry into information that others are unwilling to share
- I take responsibility for my mistakes at work
- I do my best to complete the work I am responsible for

Please ask us in the text box below if you have any questions or suggestions regarding this questionnaire. Thank you for your suggestion.

Appendix B: Results of ordered logistic regressions predicting mark by humanistic knowledge and skills.

Predictors	Industrial design			Product design			Visual communication			Environmental Art		
	Odds Ratios	CI	*p*	Odds Ratios	CI	*p*	Odds Ratios	CI	*p*	Odds Ratios	CI	*p*
y≥75–84.99	55.42	17.67–173.79	<0.001	9.52	4.76–19.05	<0.001	8.34	4.44–15.65	<0.001	25.90	10.55–63.60	<0.001
y≥85–94.99	2.61	1.85–3.66	<0.001	1.04	0.69–1.56	0.868	1.38	0.93–2.07	0.112	1.73	1.20–2.47	0.003
y≥95–100	0.01	0.00–0.05	<0.001	0.01	0.00–0.08	<0.001	0.03	0.01–0.08	<0.001			
Knowledge & skills	0.97	0.62–1.50	0.874	0.89	0.57–1.41	0.629	1.65	1.02–2.68	0.042	0.73	0.47–1.14	0.164
y≥65–74.99				46.57	11.43–189.79	<0.001	103.46	14.41–742.68	<0.001	133.20	18.59–954.60	<0.001
Observations	170			93			102			130		
R^2	0.000			0.003			0.049			0.018		

Appendix C: Results of ordered logistic regressions predicting mark by humanistic capabilities.

Predictors	Industrial design			Product design			Visual communication			Environmental art		
	Odds ratios	CI	*p*	Odds ratios	CI	*p*	Odds ratios	CI	*p*	Odds ratios	CI	*p*
y≥75–84.99	0.38	0.02–6.28	0.496	0.37	0.03–5.09	0.455	0.28	0.02–3.82	0.340	0.44	0.02–8.63	0.586
y≥85–94.99	0.02	0.00–0.23	0.003	0.04	0.00–0.53	0.015	0.04	0.00–0.63	0.022	0.03	0.00–0.53	0.017
y≥95–100	0.00	0.00–0.00	<0.001	0.00	0.00–0.01	<0.001	0.00	0.00–0.02	<0.001			
capabilities	3.98	1.90–8.31	<0.001	2.43	1.20–4.95	0.014	2.58	1.25–5.30	0.010	2.98	1.37–6.52	0.006
y≥65–74.99				1.79	0.10–32.45	0.695	3.51	0.14–85.76	0.442	2.26	0.07–71.85	0.643
Observations	170			93			102			130		
R^2	0.110			0.077			0.075			0.076		

Appendix D: Results of ordered logistic regressions predicting mark by humanistic spirits.

Predictors	Industrial design			Product design			Visual communication			Environmental art		
	Odds ratios	CI	*p*	Odds ratios	CI	*p*	Odds ratios	CI	*p*	Odds ratios	CI	*p*
y≥75–84.99	3.36	0.17–65.28	0.423	6.03	0.47–78.07	0.169	5.55	0.34–90.79	0.229	2.62	0.17–39.50	0.488
y≥85–94.99	0.15	0.01–2.51	0.189	0.66	0.05–8.15	0.745	0.96	0.06–15.10	0.976	0.17	0.01–2.43	0.193
y≥95–100	0.00	0.00–0.02	<0.001	0.01	0.00–0.17	0.002	0.02	0.00–0.40	0.010			
spirits	1.98	1.01–3.90	0.047	1.11	0.61–2.03	0.729	1.10	0.57–2.14	0.774	1.71	0.92–3.18	0.088
y≥65–74.99				29.37	1.71–504.15	0.020	67.76	2.35–1956.23	0.014	13.56	0.54–341.48	0.113
Observations	170			93			102			130		
R^2	0.031			0.001			0.001			0.028		