**Appendix**

**Appendix 1：**

Information of big data analytics courses in eight universities

|  |  |  |  |
| --- | --- | --- | --- |
| **University** | **Course code** | **Course name** | **Student Level** |
| Columbia University | EECS E6893 | Big Data Analytics | Masters and PhDs |
| Carnegie Mellon University | 67-362/A3 | Big Data Analytics | Undergraduates and Masters |
| Wright State University |  | Big Data Analytics | Undergraduates and Masters |
| Stetson University | CINF 401 | Big Data Mining and Analytics | Undergraduates |
| BSAN 398 | Databases and Big Data |
| Central South University | 47081202B04 | Data Science and Engineering | Undergraduates and Masters |
| 47081202B03 | Data Mining |
| 47081202D03 | Data Visualization |
| University of Chinese Academy of Sciences | 120400MGX005H | Public Big Data Processing and Analysis | Undergraduates and Masters |
| Harbin Institute of Technology | MATH3003 | Big Data Analytics | Undergraduates |
| MATH3008 | Data Mining |
| MATH3007 | Data Visualization |
| Xi’an Jiaotong University | 072132 | Big Data Analytics Basics | Maters |
| 073010 | Big data analysis and processing methods |

**Appendix 2：**

The scale of the impact of big data analytics courses on the six ability dimensions of engineering students

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Item  labels | Items | Source |
| Big data analytics Skills | BDAS1 | I will enforce adequate plans for the introduction and utilization of big data analytics. | (85) |
| BDAS2 | I usually perform big data analytics planning processes in systematic and formalized ways. |
| BDAS3 | I show superior understanding of technological trends. |
| BDAS4 | I can quickly isolate valuable information from large amounts of data |
| BDAS5 | I can quickly discover potentially useful knowledge from large amounts of data |
| Comunica  -tion Skills | CS1 | I use my feelings to determine how I should communicate. | (118, 119) |
| CS2 | Even if I do not receive a clear response from others, I can understand what they intended. |
| CS3 | When I disagree with someone, I avoid direct conflict. |
| CS4 | I argue my case to show the merits of my position. |
| CS5 | I can accept continuous talks |
| CS6 | I would ask him to explain his meaning in full by asking |
| Decision Making  Skill | DMS1 | I feel confident about my ability to makes decisions. | (120) |
| DMS2 | I consider how best to carry out a decision. |
| DMS3 | When making decisions I like to collect a lot of information. |
| DMS4 | I do not make decisions unless I really have to. |
| DMS5 | I feel as if I am under tremendous time pressure when making decisions. |
| Critical Thinking  Skills | CTS1 | I am able to carefully consider the context of a problem and make a deliberate judgment. | (119) |
| CTS2 | I will seek alternative solutions to problems. |
| CTS3 | I am willing to adopt possible solutions that go beyond existing procedures or regulations. |
| CTS4 | I can systematically deal with problems and available solutions. |
| CTS5 | I will seek reasons and evidence to support offered assertions and evaluations. |
| CTS6 | I can anticipate potential difficulties and suggests possible responses before problems arise. |
| Technology  skills | TS1 | I can use big data platforms and tools such as Hadoop, HBase, MongoDB, NoSQL, etc. | (85, 121) |
| TS2 | I am very capable in the areas of data and network management and maintenance. |
| TS3 | I am very capable in terms of programming skills. |
| Knowledge  skills | KS1 | I mastered the technical theory of big data analytics, database principles. | (122) |
| KS2 | I have improved my learning efficiency and knowledge retention through the big data analytics course. |
| KS3 | I am able to use big data tools or platforms to search and extract massive amounts of knowledge. |

The scale of self‐perceived employability of engineering student

|  |  |  |  |
| --- | --- | --- | --- |
| Knowledge  Capability | KC1 | I will continue to improve my professional knowledge system. | (80) |
| KC2 | I am able to apply the theoretical knowledge I have learned in practice. |
| KC3 | I have a wealth of cross-cultural knowledge. |
| Lifelong Learning  Capability | LL1 | I expect to go on learning for a long time. | (123) |
| LL2 | I like learning new things when I can see how they make sense for me in my life. |
| LL3 | I like to try out new learning in different ways. |
| LL4 | Whether in the practicum, classroom or on my own, I am able to follow my own plan of learning. |
| LL5 | My successes and failures inspire me to continue learning. |
| Problem- Solving  Capability | PSC1 | I do not give up solving problems when first attempt fails. | (124) |
| PSC2 | I will examine factors contributing to problems. |
| PSC3 | I will approach problems from many angles. |
| PSC4 | I will think of as many options as possible. |
| PSC5 | I believe I can solve a problem if I try hard enough. |
| Teamwork  Capability | TC1 | I am actively involved in team activities. | (125) |
| TC2 | I can integrate into the team and continuously improve team cohesion. |
| TC3 | I can find a way to mediate the disagreements and conflicts. |
| TC4 | When I communicate with others, I listen carefully to each other’s conversations. |
| TC5 | I can consider other people’s opinions comprehensively in teamwork. |
| Innovation  Capability | IC1 | I am good at coming up with innovative ideas. | (126) |
| IC2 | I am confident in my creative problem-solving skills. |
| IC3 | I am good at finding new ways to solve problems. |
| IC4 | I am able to explore a wide range of knowledge and find my own interests and directions. |
| IC5 | I constantly question what I have learned and often offer my own unique ideas. |
| Leadership  Capability | LC1 | I value completing assignments to the best of my ability over taking advantage of possible loopholes. | (127) |
| LC2 | My behavior is pretty consistent from day to day. |
| LC3 | I usually show a great deal of self-discipline. |
| LC4 | I build relationships with others at school or work. |
| LC5 | I develop a positive rapport with my teammates. |

**Appendix 3：**

Descriptive statistics and correlation analysis

The descriptive statistics and correlation of studied variables

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 1. Knowledge skill | 3.314 | 0.895 | 0.895 |  |  |  |  |  |  |  |  |
| 2. Decision-making skill | 3.695 | 0.479 | 0.284\*\*\* | 0.710 |  |  |  |  |  |  |  |
| 3. Critical thinking skill | 3.830 | 0.558 | 0.083 | 0.623\*\*\* | 0.806 |  |  |  |  |  |  |
| 4. Technology skill | 2.346 | 0.990 | 0.585\*\*\* | 0.200\* | 0.140 | 0.925 |  |  |  |  |  |
| 5. Big data analytics skill | 2.800 | 0.867 | 0.573\*\*\* | 0.163\* | 0.096 | 0.738\*\*\* | 0.890 |  |  |  |  |
| 6. Communication skill | 3.675 | 0.574 | 0.237\*\* | 0.233\*\* | 0.428\*\*\* | 0.213\*\* | 0.302\*\*\* | 0.753 |  |  |  |
| 7. Human capital | 3.727 | 0.555 | 0.314\*\* | 0.527\*\* | 0.676\*\* | 0.330\*\* | 0.368\*\* | 0.576\*\* | 0.806 |  |  |
| 8. Individual attributes | 3.809 | 0.508 | 0.312\*\*\* | 0.610\*\*\* | 0.682\*\*\* | 0.261\*\* | 0.282\*\*\* | 0.447\*\*\* | 0.806\*\*\* | 0.773 |  |
| 9. Career development | 3.769 | 0.540 | 0.339\*\*\* | 0.591\*\*\* | 0.613\*\*\* | 0.299\*\*\* | 0.288\*\*\* | 0.397\*\*\* | 0.707\*\*\* | 0.790\*\*\* | 0.796 |

Note: The coefficients represent in the diagonal are the square root value of AVE. SD=standard deviation. \* *p* <0.05, \*\* *p* < 0.01, \*\*\* *p* < 0.001.

**Appendix 4:**

Results of CITC and alpha-coefficient analysis of study variables

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Dimension | Corrected Item and Total Correlation | Alpha |
| KS1 | KS | .491 | 0.875 |
| KS2 | .490 |
| KS3 | .387 |
| DMS1 | DMS | .569 | 0.740 |
| DMS2 | .511 |
| DMS3 | .565 |
| DMS4 | .252 |
| DMS5 | .209 |
| CTS1 | CTS | .570 | 0.889 |
| CTS2 | .529 |
| CTS3 | .538 |
| CTS4 | .583 |
| CTS5 | .551 |
| CTS6 | .525 |
| TS1 | TS | .473 | 0.915 |
| TS2 | .485 |
| TS3 | .491 |
| BDAS1 | BDAS | .462 | 0.934 |
| BDAS2 | .455 |
| BDAS3 | .530 |
| BDAS4 | .513 |
| BDAS5 | .505 |
| CS1 | CS | .389 | 0.846 |
| CS2 | .458 |
| CS3 | .337 |
| CS4 | .475 |
| CS5 | .516 |
| CS6 | .424 |
| KC1 | KC | .609 | 0.817 |
| KC2 | .620 |
| KC3 | .566 |
| LL1 | LL | .612 | 0.898 |
| LL2 | .630 |
| LL3 | .605 |
| LL4 | .648 |
| LL5 | .622 |
| TC1 | TC | .509 | 0.866 |
| TC2 | .598 |
| TC3 | .614 |
| TC4 | .549 |
| TC5 | .550 |
| IC1 | IC | .581 | 0.917 |
| IC2 | .653 |
| IC3 | .631 |
| IC4 | .622 |
| IC5 | .676 |
| PSC1 | PSC | .692 | 0.891 |
| PSC2 | .697 |
| PSC3 | .764 |
| PSC4 | .639 |
| PSC5 | .607 |
| LC1 | LC | .653 | 0.847 |
| LC2 | .601 |
| LC3 | .635 |
| LC4 | .632 |
| LC5 | .606 |

Note: CITC=Corrected Item-Total Correlation

**Appendix 5:**

|  |  |  |
| --- | --- | --- |
| Dimension | KMO | P |
| KS | 0.671 | < 0.001 |
| DMS | 0.569 | < 0.001 |
| CTS | 0.880 | < 0.001 |
| TS | 0.713 | < 0.001 |
| BDAS | 0.813 | < 0.001 |
| CS | 0.837 | < 0.001 |
| KC | 0.672 | < 0.001 |
| LL | 0.842 | < 0.001 |
| TC | 0.819 | < 0.001 |
| IC | 0.869 | < 0.001 |
| PSC | 0.862 | < 0.001 |
| LC | 0.799 | < 0.001 |

Note: KMO= Kaiser-Meyer-Olkin