

**Table 1S.** Survey questionnaire on environmental chemistry learning initiative among undergraduates

| Question number | Questions                                                                                                                                              | Completely inconsistent | Not quite in line | Rarely does it meet the requirements | More in line | Full compliance |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------|--------------------------------------|--------------|-----------------|
| 1               | I really enjoy environmental specialized courses                                                                                                       | 1                       | 2                 | 3                                    | 4            | 5               |
| 2               | I think environmental specialized courses are very important                                                                                           | 1                       | 2                 | 3                                    | 4            | 5               |
| 3               | My main motivation for studying environmental engineering is interest in environmental specialized courses                                             | 1                       | 2                 | 3                                    | 4            | 5               |
| 4               | I actively review and preview environmental specialized courses                                                                                        | 1                       | 2                 | 3                                    | 4            | 5               |
| 5               | I think the current learning atmosphere for environmental specialized courses is very active                                                           | 1                       | 2                 | 3                                    | 4            | 5               |
| 6               | When encountering new refractory organic pollutants, I can propose feasible methods for degrading the pollutants based on advanced oxidation processes | 1                       | 2                 | 3                                    | 4            | 5               |
| 7               | When the teacher arranged the discussion, I actively participated and expressed my opinions                                                            | 1                       | 2                 | 3                                    | 4            | 5               |
| 8               | I will actively reflect on the questions raised by the teacher                                                                                         | 1                       | 2                 | 3                                    | 4            | 5               |
| 9               | I can actively participate in group collaborative learning                                                                                             | 1                       | 2                 | 3                                    | 4            | 5               |
| 10              | I can proactively consult literature on pollution control methods                                                                                      | 1                       | 2                 | 3                                    | 4            | 5               |

**Table 2S.** Survey percentage statistics on innovative thinking of undergraduates

| Questions                                                                                                                                                       | Options                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Undergraduates participating in the innovation experiment (%)                                       | Undergraduates in the control group (%)                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Can questions with exploratory value be raised in innovative experimental courses?                                                                              | <ul style="list-style-type: none"> <li>◆ Questions with exploratory value can be raised</li> <li>❖ Questions can be identified but cannot determine their value</li> <li>◆ Discovered questions cannot be expressed</li> <li>☒ Difficult to detect question</li> </ul>                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>◆ 33%</li> <li>❖ 45%</li> <li>◆ 15%</li> <li>☒ 7%</li> </ul> | <ul style="list-style-type: none"> <li>◆ 28%</li> <li>❖ 42%</li> <li>◆ 20%</li> <li>☒ 10%</li> </ul> |
| Will interdisciplinary knowledge be utilized in problem-solving in innovative experimental courses?                                                             | <ul style="list-style-type: none"> <li>◆ Often uses interdisciplinary knowledge</li> <li>❖ Occasionally, there may be</li> <li>◆ Almost no</li> </ul>                                                                                                                                                                                                                                                                                                                                                          | <ul style="list-style-type: none"> <li>◆ 72%</li> <li>❖ 20%</li> <li>◆ 8%</li> </ul>                | <ul style="list-style-type: none"> <li>◆ 43%</li> <li>❖ 38%</li> <li>◆ 19%</li> </ul>                |
| Is there any idea for improving experimental equipment or steps in innovative experimental courses?                                                             | <ul style="list-style-type: none"> <li>◆ Yes, and can propose clear improvement plans</li> <li>❖ Has, but cannot propose a definite improvement plan</li> <li>◆ No</li> </ul>                                                                                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>◆ 36%</li> <li>❖ 54%</li> <li>◆ 10%</li> </ul>               | <ul style="list-style-type: none"> <li>◆ 18%</li> <li>❖ 57%</li> <li>◆ 25%</li> </ul>                |
| Will actively analyze the reasons and take effective measures if the experimental phenomena are different from expectations in innovative experimental courses? | <ul style="list-style-type: none"> <li>◆ Repeat the experiment according to the formulated experimental plan and steps and then to analyzing again</li> <li>❖ After verifying the experimental operation according to the formulated experimental plan and steps, independently analyze and then to discussing with undergraduates in the same group</li> <li>◆ Directly asks the experimental teachers</li> <li>☒ Waiting for experimental teachers or undergraduates in the same group to arrange</li> </ul> | <ul style="list-style-type: none"> <li>◆ 23%</li> <li>❖ 62%</li> <li>◆ 15%</li> <li>☒ 0%</li> </ul> | <ul style="list-style-type: none"> <li>◆ 36%</li> <li>❖ 24%</li> <li>◆ 32%</li> <li>☒ 8%</li> </ul>  |
| Will want to design self experimental plan to treat environmental pollutants?                                                                                   | <ul style="list-style-type: none"> <li>◆ Able to design experimental plan and has implemented it under the guidance of experimental teachers</li> <li>❖ Has ideas, but has not designed an experimental plan</li> <li>◆ Never thought about it</li> </ul>                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>◆ 44%</li> <li>❖ 53%</li> <li>◆ 3%</li> </ul>                | <ul style="list-style-type: none"> <li>◆ 9%</li> <li>❖ 48%</li> <li>◆ 43%</li> </ul>                 |