

# CSCI927 Service-Oriented Software Engineering (Progress Report)

## Online study lounge system based on SOA

*Liting Lyu (6603324), Yueyue He (6603671), Muzhe Peng (6603646), Wangzhihui Mei (6603385)*

### 1 Progress

#### 1.1 Interaction Module

In order to better description the service, the model is further designed according to the proposal. The must-have modules have finished designing, which includes Updates Issue module, Search module and Message Processing Module. The technology of Business Process Modeling Notation(BPMN) and corresponding Extensive Markup Language(XML) are used to denote well-organized and predictable process, Case Management Model and Notation(CMMN) is used to describe the unpredictable process. More details are included in the appendix.

#### 1.2 Q&A Module

For Q&A module, We have developed Question Service and Answer Service along with interaction with Follow Service, Push Service. Down-top design was used to build the system, dividing the application into two layer: basic layer and business logic layer. The SOA pattern was referred in building the System, dividing Question Services and Answer Services into atomic services. BPMN model was used to describe the business process model of the Q&A module in the view of users. Also, We use CMMN model to describe the case model of the moduel. The according xml files are offered.

#### 1.3 Personal Module

The functions of the personal module have been analyzed and described as services that can be provided to users. The business processes of login service, modification of personal information service and learning plan service are formulated and represented by Business Process Modeling Notation(BPMN) and Extensive Markup Language(XML) technology. At the same time, Case Management Model and Notation(CMMN) and XML technology are used to represent the logic of learning report generation service. More details are included in the appendix.

#### 1.4 Self Study Module

On the basis of the proposal, the services of the self-study module are re-combed and refined. The models of the necessary services of this module are designed, including self-study room service, attendance service and learning task service. The technology of Business Process Modeling Notation (BPMN), Extensible Markup Language (XML) is used to design the ordered business model process. Case Management Model and Notation (CMMN) is used to design the business model process in an unpredictable order. Detailed business models can be seen in the appendix.

### Next plan

- 1.Design the good-to-have services
- 2.Try to apply more technology.
- 3.Make all business processes of personal module, and make corresponding interface to interact with other modules.
- 4.Design the system with richer models.

# Appendix

## Project Title: Online study lounge system based on SOA

Group Members (Group number): Liting Lyu (6603324), Yueyue He (6603671),  
Muzhe Peng (6603646), Wangzhihui Mei (6603385)

### Question Service BPMN Model and XML

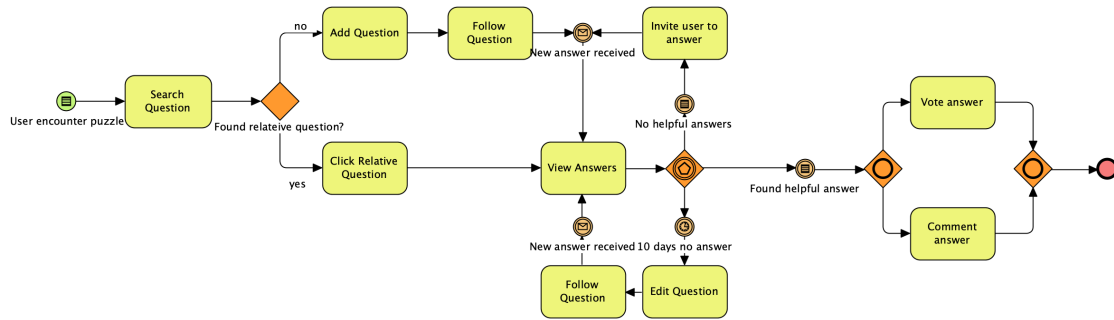


Fig. 1. Question Service

```
<process id="_1" isExecutable="false" name="QuestionService">
  <task completionQuantity="1" id="BP06_BP12" isForCompensation="
    false" name="Search Question">
    <incoming>BP06_BP22</incoming>
    <outgoing>BP06_BP24</outgoing>
  </task>
  <startEvent id="BP06_BP13" isInterrupting="true" name="User
    encounter puzzle">
    <outgoing>BP06_BP22</outgoing>
    <conditionalEventDefinition id="
      ID_14404272_1627_3203_7600_000000200040">
      <condition/>
    </conditionalEventDefinition>
  </startEvent>
  <sequenceFlow id="BP06_BP22" name="" sourceRef="BP06_BP13"
    targetRef="BP06_BP12"/>
  <exclusiveGateway gatewayDirection="Unspecified" id="BP06_BP23"
    name="Found relative question?">
    <incoming>BP06_BP24</incoming>
    <outgoing>BP06_BP29</outgoing>
    <outgoing>BP06_BP30</outgoing>
  </exclusiveGateway>
  <sequenceFlow id="BP06_BP24" name="" sourceRef="BP06_BP12"
    targetRef="BP06_BP23"/>
  <task completionQuantity="1" id="BP06_BP27" isForCompensation="
    false" name="Add Question">
```

```

        <incoming>BP06_BP29</incoming>
        <outgoing>BP06_BP40</outgoing>
    </task>
    <task completionQuantity="1" id="BP06_BP28" isForCompensation="
        false" name="Click Relative Question">
        <incoming>BP06_BP30</incoming>
        <outgoing>BP06_BP43</outgoing>
    </task>
    <sequenceFlow id="BP06_BP29" name="no" sourceRef="BP06_BP23"
        targetRef="BP06_BP27"/>
    <sequenceFlow id="BP06_BP30" name="yes" sourceRef="BP06_BP23"
        targetRef="BP06_BP28"/>
    <task completionQuantity="1" id="BP06_BP37" isForCompensation="
        false" name="View Answers">
        <incoming>BP06_BP43</incoming>
        <incoming>BP06_BP44</incoming>
        <incoming>BP06_BP88</incoming>
        <outgoing>BP06_BP71</outgoing>
    </task>
    <task completionQuantity="1" id="BP06_BP39" isForCompensation="
        false" name="Follow Question">
        <incoming>BP06_BP40</incoming>
        <outgoing>BP06_BP42</outgoing>
    </task>
    <sequenceFlow id="BP06_BP40" name="" sourceRef="BP06_BP27"
        targetRef="BP06_BP39"/>
    <intermediateCatchEvent id="BP06_BP41" name="New answer received">
        <incoming>BP06_BP42</incoming>
        <incoming>BP06_BP62</incoming>
        <outgoing>BP06_BP44</outgoing>
        <messageEventDefinition id="
            ID_54404272_1627_3203_7600_000000200041"/>
    </intermediateCatchEvent>
    <sequenceFlow id="BP06_BP42" name="" sourceRef="BP06_BP39"
        targetRef="BP06_BP41"/>
    <sequenceFlow id="BP06_BP43" name="" sourceRef="BP06_BP28"
        targetRef="BP06_BP37"/>
    <sequenceFlow id="BP06_BP44" name="" sourceRef="BP06_BP41"
        targetRef="BP06_BP37"/>
    <endEvent id="BP06_BP45" name="">
        <incoming>BP06_BP69</incoming>
    </endEvent>
    <inclusiveGateway gatewayDirection="Unspecified" id="BP06_BP51"
        name="Gateway">
        <incoming>BP06_BP73</incoming>
        <outgoing>BP06_BP55</outgoing>
        <outgoing>BP06_BP65</outgoing>
    </inclusiveGateway>
    <task completionQuantity="1" id="BP06_BP53" isForCompensation="
        false" name="Comment answer">
        <incoming>BP06_BP55</incoming>
        <outgoing>BP06_BP68</outgoing>

```

```

</task>
<sequenceFlow id="BP06_BP55" name="" sourceRef="BP06_BP51"
  targetRef="BP06_BP53"/>
<task completionQuantity="1" id="BP06_BP60" isForCompensation="
  false" name="Invite user to answer">
  <incoming>BP06_BP77</incoming>
  <outgoing>BP06_BP62</outgoing>
</task>
<sequenceFlow id="BP06_BP62" name="" sourceRef="BP06_BP60"
  targetRef="BP06_BP41"/>
<task completionQuantity="1" id="BP06_BP64" isForCompensation="
  false" name="Vote answer">
  <incoming>BP06_BP65</incoming>
  <outgoing>BP06_BP67</outgoing>
</task>
<sequenceFlow id="BP06_BP65" name="" sourceRef="BP06_BP51"
  targetRef="BP06_BP64"/>
<inclusiveGateway gatewayDirection="Unspecified" id="BP06_BP66"
  name="Gateway2">
  <incoming>BP06_BP67</incoming>
  <incoming>BP06_BP68</incoming>
  <outgoing>BP06_BP69</outgoing>
</inclusiveGateway>
<sequenceFlow id="BP06_BP67" name="" sourceRef="BP06_BP64"
  targetRef="BP06_BP66"/>
<sequenceFlow id="BP06_BP68" name="" sourceRef="BP06_BP53"
  targetRef="BP06_BP66"/>
<sequenceFlow id="BP06_BP69" name="" sourceRef="BP06_BP66"
  targetRef="BP06_BP45"/>
<eventBasedGateway gatewayDirection="Unspecified" id="BP06_BP70"
  instantiate="false" name="">
  <incoming>BP06_BP71</incoming>
  <outgoing>BP06_BP76</outgoing>
  <outgoing>BP06_BP78</outgoing>
  <outgoing>BP06_BP80</outgoing>
</eventBasedGateway>
<sequenceFlow id="BP06_BP71" name="" sourceRef="BP06_BP37"
  targetRef="BP06_BP70"/>
<intermediateCatchEvent id="BP06_BP72" name="Found helpful answer"
  >
  <incoming>BP06_BP78</incoming>
  <outgoing>BP06_BP73</outgoing>
  <conditionalEventDefinition id="
    ID_01527216_1627_3203_7600_000000200061">
    <condition/>
  </conditionalEventDefinition>
</intermediateCatchEvent>
<sequenceFlow id="BP06_BP73" name="" sourceRef="BP06_BP72"
  targetRef="BP06_BP51"/>
<intermediateCatchEvent id="BP06_BP74" name="No helpful answers">
  <incoming>BP06_BP76</incoming>
  <outgoing>BP06_BP77</outgoing>

```

```

        <conditionalEventDefinition id="
            ID_01527216_1627_3203_7600_000000200062">
            <condition/>
        </conditionalEventDefinition>
    </intermediateCatchEvent>
    <intermediateCatchEvent id="BP06_BP75" name="10 days no answer">
        <incoming>BP06_BP80</incoming>
        <outgoing>BP06_BP82</outgoing>
        <timerEventDefinition id="
            ID_01527216_1627_3203_7600_000000200063"/>
    </intermediateCatchEvent>
    <sequenceFlow id="BP06_BP76" name="" sourceRef="BP06_BP70"
        targetRef="BP06_BP74"/>
    <sequenceFlow id="BP06_BP77" name="" sourceRef="BP06_BP74"
        targetRef="BP06_BP60"/>
    <sequenceFlow id="BP06_BP78" name="" sourceRef="BP06_BP70"
        targetRef="BP06_BP72"/>
    <sequenceFlow id="BP06_BP80" name="" sourceRef="BP06_BP70"
        targetRef="BP06_BP75"/>
    <task completionQuantity="1" id="BP06_BP81" isForCompensation="
        false" name="Edit Question">
        <incoming>BP06_BP82</incoming>
        <outgoing>BP06_BP84</outgoing>
    </task>
    <sequenceFlow id="BP06_BP82" name="" sourceRef="BP06_BP75"
        targetRef="BP06_BP81"/>
    <task completionQuantity="1" id="BP06_BP83" isForCompensation="
        false" name="Follow Question">
        <incoming>BP06_BP84</incoming>
        <outgoing>BP06_BP87</outgoing>
    </task>
    <sequenceFlow id="BP06_BP84" name="" sourceRef="BP06_BP81"
        targetRef="BP06_BP83"/>
    <intermediateCatchEvent id="BP06_BP86" name="New answer received">
        <incoming>BP06_BP87</incoming>
        <outgoing>BP06_BP88</outgoing>
        <messageEventDefinition id="
            ID_41527216_1627_3203_7600_000000200064"/>
    </intermediateCatchEvent>
    <sequenceFlow id="BP06_BP87" name="" sourceRef="BP06_BP83"
        targetRef="BP06_BP86"/>
    <sequenceFlow id="BP06_BP88" name="" sourceRef="BP06_BP86"
        targetRef="BP06_BP37"/>
</process>

```

## Answer Service BPMN Model and XML

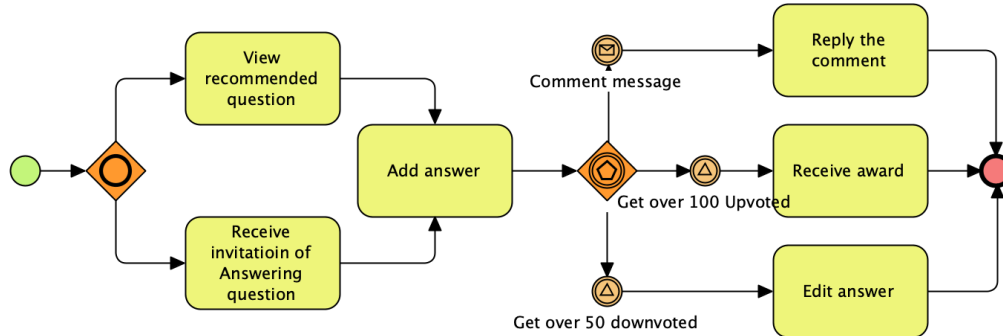


Fig. 2. Answer Service

```

<process id="_4" isExecutable="false" name="AnswerService">
  <task completionQuantity="1" id="BP80_BP02" isForCompensation="
    false" name="View recommended question" startQuantity="1">
    <incoming>BP80_BP27</incoming>
    <outgoing>BP80_BP05</outgoing>
  </task>
  <task completionQuantity="1" id="BP80_BP04" isForCompensation="
    false" name="Add answer" startQuantity="1">
    <incoming>BP80_BP05</incoming>
    <incoming>BP80_BP29</incoming>
    <outgoing>BP80_BP11</outgoing>
  </task>
  <sequenceFlow id="BP80_BP05" name="" sourceRef="BP80_BP02"
    targetRef="BP80_BP04" />
  <eventBasedGateway gatewayDirection="Unspecified" id="BP80_BP10"
    instantiate="false" name="">
    <incoming>BP80_BP11</incoming>
    <outgoing>BP80_BP17</outgoing>
    <outgoing>BP80_BP16</outgoing>
    <outgoing>BP80_BP34</outgoing>
  </eventBasedGateway>
  <sequenceFlow id="BP80_BP11" name="" sourceRef="BP80_BP04"
    targetRef="BP80_BP10" />
  <task completionQuantity="1" id="BP80_BP12" isForCompensation="
    false" name="Reply the comment" startQuantity="1">
    <incoming>BP80_BP19</incoming>
    <outgoing>BP80_BP40</outgoing>
  </task>
  <intermediateCatchEvent id="BP80_BP13" name="Comment message">
    <incoming>BP80_BP17</incoming>
    <outgoing>BP80_BP19</outgoing>
  </intermediateCatchEvent>
</process>
  
```

```

        <messageEventDefinition id="
            ID_47301753_1627_3203_7600_000000200121" />
    </intermediateCatchEvent>
    <sequenceFlow id="BP80_BP17" name="" sourceRef="BP80_BP10"
        targetRef="BP80_BP13" />
    <sequenceFlow id="BP80_BP19" name="" sourceRef="BP80_BP13"
        targetRef="BP80_BP12" />
    <task completionQuantity="1" id="BP80_BP23" isForCompensation="
        false" name="Receive invitatioin of Answering question"
        startQuantity="1">
        <incoming>BP80_BP28</incoming>
        <outgoing>BP80_BP29</outgoing>
    </task>
    <startEvent id="BP80_BP24" name="">
        <outgoing>BP80_BP26</outgoing>
    </startEvent>
    <inclusiveGateway gatewayDirection="Unspecified" id="BP80_BP25"
        name="">
        <incoming>BP80_BP26</incoming>
        <outgoing>BP80_BP27</outgoing>
        <outgoing>BP80_BP28</outgoing>
    </inclusiveGateway>
    <sequenceFlow id="BP80_BP26" name="" sourceRef="BP80_BP24"
        targetRef="BP80_BP25" />
    <sequenceFlow id="BP80_BP27" name="" sourceRef="BP80_BP25"
        targetRef="BP80_BP02" />
    <sequenceFlow id="BP80_BP28" name="" sourceRef="BP80_BP25"
        targetRef="BP80_BP23" />
    <sequenceFlow id="BP80_BP29" name="" sourceRef="BP80_BP23"
        targetRef="BP80_BP04" />
    <sequenceFlow id="BP80_BP16" name="" sourceRef="BP80_BP10"
        targetRef="BP80_BP14" />
    <intermediateCatchEvent id="BP80_BP14" name="Get over 100 Upvoted"
        >
        <incoming>BP80_BP16</incoming>
        <outgoing>BP80_BP32</outgoing>
        <signalEventDefinition id="
            ID_27301753_1627_3203_7600_000000200122" />
    </intermediateCatchEvent>
    <task completionQuantity="1" id="BP80_BP31" isForCompensation="
        false" name="Receive award" startQuantity="1">
        <incoming>BP80_BP32</incoming>
        <outgoing>BP80_BP41</outgoing>
    </task>
    <sequenceFlow id="BP80_BP32" name="" sourceRef="BP80_BP14"
        targetRef="BP80_BP31" />
    <intermediateCatchEvent id="BP80_BP33" name="Get over 50 downvoted"
        ">
        <incoming>BP80_BP34</incoming>
        <outgoing>BP80_BP36</outgoing>
        <signalEventDefinition id="
            ID_27301753_1627_3203_7600_000000200123" />

```

```

</intermediateCatchEvent>
<sequenceFlow id="BP80_BP34" name="" sourceRef="BP80_BP10"
  targetRef="BP80_BP33" />
<task completionQuantity="1" id="BP80_BP35" isForCompensation="
  false" name="Edit answer" startQuantity="1">
  <incoming>BP80_BP36</incoming>
  <outgoing>BP80_BP42</outgoing>
</task>
<sequenceFlow id="BP80_BP36" name="" sourceRef="BP80_BP33"
  targetRef="BP80_BP35" />
<endEvent id="BP80_BP37" name="">
  <incoming>BP80_BP40</incoming>
  <incoming>BP80_BP41</incoming>
  <incoming>BP80_BP42</incoming>
</endEvent>
<sequenceFlow id="BP80_BP40" name="" sourceRef="BP80_BP12"
  targetRef="BP80_BP37" />
<sequenceFlow id="BP80_BP41" name="" sourceRef="BP80_BP31"
  targetRef="BP80_BP37" />
<sequenceFlow id="BP80_BP42" name="" sourceRef="BP80_BP35"
  targetRef="BP80_BP37" />
</process>

```

Q&A Service CMMN Model and XML

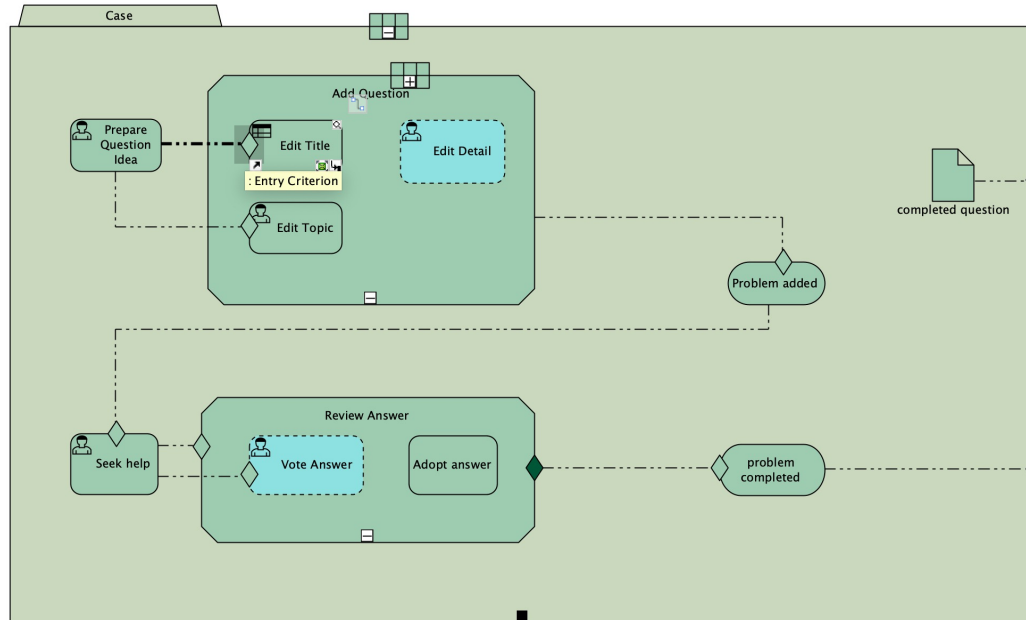
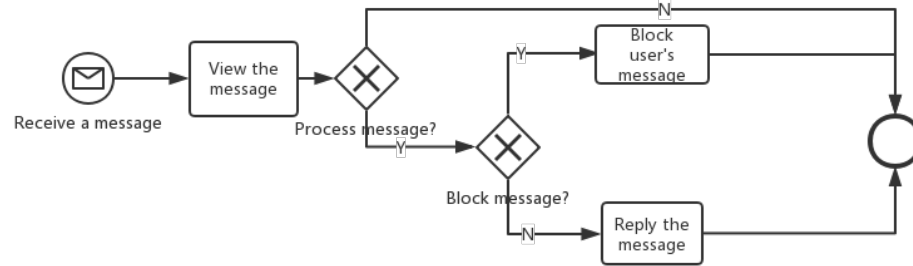


Fig. 3. Q&A Service CMMN Model



## Message Processing Service BPMN Model and XML



**Fig. 4.** Message Management

```

<bpmn:process id="Process_1" isExecutable="true">
  <bpmn:startEvent id="StartEvent">
    <bpmn:outgoing>SequenceFlow_1</bpmn:outgoing>
    <bpmn:messageEventDefinition/>
  </bpmn:startEvent>
  <bpmn:sequenceFlow id="SequenceFlow_1" sourceRef="StartEvent" targetRef="
    Task_1" />
  <bpmn:task id="Task_1" name="View the message">
    <bpmn:incoming>SequenceFlow_1</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_2</bpmn:outgoing>
  </bpmn:task>
  <bpmn:sequenceFlow id="SequenceFlow_2" sourceRef="Task_1" targetRef="
    ExclusiveGateway_1" />
  <bpmn:exclusiveGateway id="ExclusiveGateway_1" name="Process message?">
    <bpmn:incoming>SequenceFlow_2</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_3</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_4</bpmn:outgoing>
  </bpmn:exclusiveGateway>
  <bpmn:sequenceFlow id="SequenceFlow_3" sourceRef="ExclusiveGateway_1"
    targetRef="EndEvent"/>
    <bpmn:conditionExpression
      xsi:type="bpmn:tFormalExpression">N</bpmn:conditionExpression>
  </bpmn:sequenceFlow>
  <bpmn:sequenceFlow id="SequenceFlow_4" sourceRef="ExclusiveGateway_1"
    targetRef="ExclusiveGateway_2" />
    <bpmn:conditionExpression
      xsi:type="bpmn:tFormalExpression">Y</bpmn:conditionExpression>
  </bpmn:sequenceFlow>
  <bpmn:task id="Task_2" name="Block user's message">
    <bpmn:incoming>SequenceFlow_4</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_5</bpmn:outgoing>
  </bpmn:task>
  <bpmn:task id="Task_3" name="Reply the message">
    <bpmn:incoming>SequenceFlow_5</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_6</bpmn:outgoing>
  </bpmn:task>
  <bpmn:sequenceFlow id="SequenceFlow_5" sourceRef="Task_2" targetRef="
    ExclusiveGateway_2" />
  <bpmn:sequenceFlow id="SequenceFlow_6" sourceRef="Task_3" targetRef="
    EndEvent" />
  <bpmn:endEvent id="EndEvent">
    <bpmn:incoming>SequenceFlow_3</bpmn:incoming>
    <bpmn:incoming>SequenceFlow_6</bpmn:incoming>
  </bpmn:endEvent>
</bpmn:process>
  
```

```

</bpmn:sequenceFlow>
  <bpmn:exclusiveGateway id="ExclusiveGateway_2" name="Block message?">
    <bpmn:incoming>SequenceFlow_4</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_5</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_6</bpmn:outgoing>
  </bpmn:exclusiveGateway>
  <bpmn:sequenceFlow id="SequenceFlow_5" sourceRef="ExclusiveGateway_2"
    targetRef="Task_2" />
    <bpmn:conditionExpression
      xsi:type="bpmn:tFormalExpression">Y</bpmn:conditionExpression>
  </bpmn:sequenceFlow>
  <bpmn:sequenceFlow id="SequenceFlow_6" sourceRef="ExclusiveGateway_2"
    targetRef="Task_3" />
    <bpmn:conditionExpression
      xsi:type="bpmn:tFormalExpression">N</bpmn:conditionExpression>
  </bpmn:sequenceFlow>
  <bpmn:task id="Task_2" name="Block user's message">
    <bpmn:incoming>SequenceFlow_5</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_7</bpmn:outgoing>
  </bpmn:task>
  <bpmn:task id="Task_3" name="Reply the message">
    <bpmn:incoming>SequenceFlow_6</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_8</bpmn:outgoing>
  </bpmn:task>
  <bpmn:sequenceFlow id="SequenceFlow_7" sourceRef="Task_2" targetRef="EndEvent
    " />
  <bpmn:sequenceFlow id="SequenceFlow_8" sourceRef="Task_3" targetRef="EndEvent
    " />
  <bpmn:endEvent id="EndEvent">
    <bpmn:ingoing>SequenceFlow_3</bpmn:ingoing>
    <bpmn:ingoing>SequenceFlow_7</bpmn:ingoing>
    <bpmn:ingoing>SequenceFlow_8</bpmn:ingoing>
  </bpmn:endEvent>
</bpmn:process>

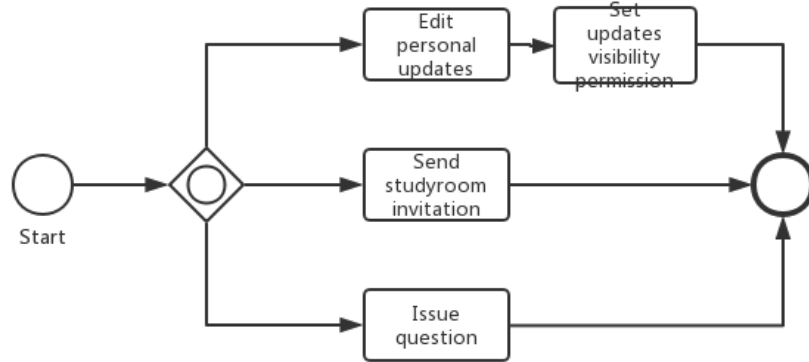
```

## Issue Updates Service BPMN Model and XML

```

<bpmn:process id="Process_3" isExecutable="true">
  <bpmn:startEvent id="StartEvent">
    <bpmn:outgoing>SequenceFlow_1</bpmn:outgoing>
  </bpmn:startEvent>
  <bpmn:sequenceFlow id="SequenceFlow_1" sourceRef="StartEvent" targetRef="
    InclusiveGateway" />
  <bpmn:inclusiveGateway id="InclusiveGateway">
    <bpmn:incoming>SequenceFlow_1</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_2</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_3</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_4</bpmn:outgoing>
  </bpmn:inclusiveGateway>
  <bpmn:sequenceFlow id="SequenceFlow_2" sourceRef="InclusiveGateway" targetRef
    ="Task_1" />
  <bpmn:sequenceFlow id="SequenceFlow_3" sourceRef="InclusiveGateway" targetRef
    ="Task_2" />

```



**Fig. 5.** Updates Issue Management

```

<bpmn:sequenceFlow id="SequenceFlow_4" sourceRef="InclusiveGateway" targetRef
="Task_3" />
<bpmn:task id="Task_1" name="Edit Personal updates">
  <bpmn:ingoing>SequenceFlow_2</bpmn:ingoing>
  <bpmn:outgoing>SequenceFlow_5</bpmn:outgoing>
</bpmn:task>
<bpmn:task id="Task_2" name="Send studyroom invitation">
  <bpmn:ingoing>SequenceFlow_3</bpmn:ingoing>
  <bpmn:outgoing>SequenceFlow_6</bpmn:outgoing>
</bpmn:task>
<bpmn:task id="Task_3" name="Issue question">
  <bpmn:ingoing>SequenceFlow_4</bpmn:ingoing>
  <bpmn:outgoing>SequenceFlow_7</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_5" sourceRef="Task_1" targetRef="Task_4"
/>
<bpmn:sequenceFlow id="SequenceFlow_6" sourceRef="Task_2" targetRef="EndEvent
" />
<bpmn:sequenceFlow id="SequenceFlow_7" sourceRef="Task_3" targetRef="EndEvent
" />
<bpmn:task id="Task_4" name="Set updates visibility permission">
  <bpmn:ingoing>SequenceFlow_5</bpmn:ingoing>
  <bpmn:outgoing>EndEvent</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_8" sourceRef="Task_4" targetRef="EndEvent
" />
<bpmn:endEvent id="StartEvent">

```

```

    <bpmn:incoming>SequenceFlow_6</bpmn:incoming>
    <bpmn:incoming>SequenceFlow_7</bpmn:incoming>
    <bpmn:incoming>SequenceFlow_8</bpmn:incoming>
  </bpmn:endEvent>
</bpmn:process>

```

## Search Service BPMN Model and XML

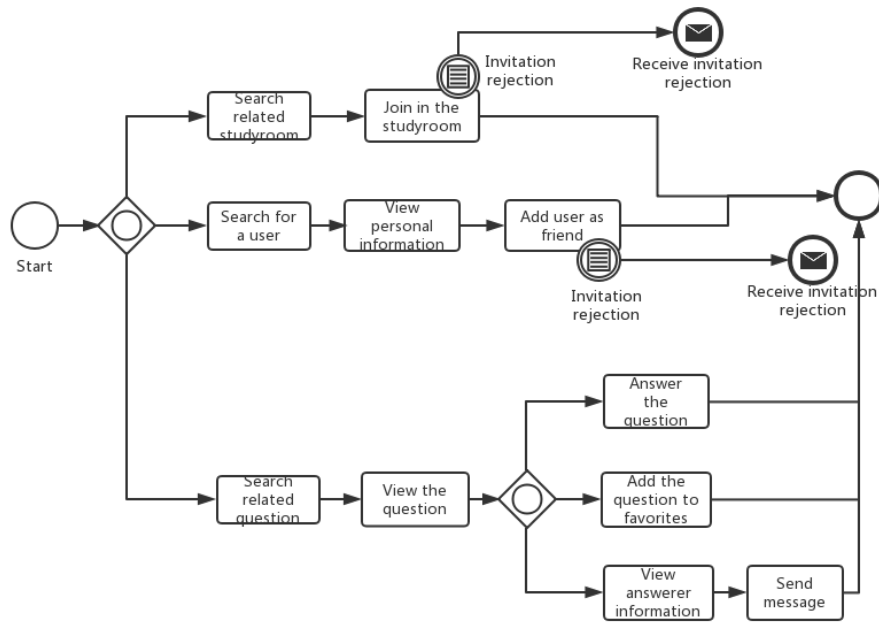


Fig. 6. Search Management

```

<bpmn:process id="Process_2" isExecutable="true">
  <bpmn:startEvent id="StartEvent">
    <bpmn:outgoing>SequenceFlow_1</bpmn:outgoing>
  </bpmn:startEvent>
  <bpmn:sequenceFlow id="SequenceFlow_1" sourceRef="StartEvent" targetRef="
    InclusiveGateway_1" />
  <bpmn:inclusiveGateway id="InclusiveGateway_1">
    <bpmn:incoming>SequenceFlow_1</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_2</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_3</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_4</bpmn:outgoing>
  </bpmn:inclusiveGateway>
  <bpmn:sequenceFlow id="SequenceFlow_2" sourceRef="InclusiveGateway_1"
    targetRef="Task_1" />

```

```

<bpmn:sequenceFlow id="SequenceFlow_3" sourceRef="InclusiveGateway_1"
  targetRef="Task_2" />
<bpmn:sequenceFlow id="SequenceFlow_4" sourceRef="InclusiveGateway_1"
  targetRef="Task_3" />
<bpmn:task id="Task_1" name="Search related studyroom">
  <bpmn:incoming>SequenceFlow_2</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_5</bpmn:outgoing>
</bpmn:task>
<bpmn:task id="Task_2" name="Search for a user">
  <bpmn:incoming>SequenceFlow_3</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_6</bpmn:outgoing>
</bpmn:task>
<bpmn:task id="Task_3" name="Search related question">
  <bpmn:incoming>SequenceFlow_4</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_7</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_5" sourceRef="Task_1" targetRef="Task_4"
  />
<bpmn:sequenceFlow id="SequenceFlow_6" sourceRef="Task_2" targetRef="Task_5"
  />
<bpmn:sequenceFlow id="SequenceFlow_7" sourceRef="Task_3" targetRef="Task_5"
  />
<bpmn:task id="Task_4" name="Join in the studyroom">
  <bpmn:incoming>SequenceFlow_5</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_9</bpmn:outgoing>
</bpmn:task>
<bpmn:task id="Task_5" name="View personal information">
  <bpmn:incoming>SequenceFlow_6</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_10</bpmn:outgoing>
</bpmn:task>
<bpmn:task id="Task_6" name="View the question">
  <bpmn:incoming>SequenceFlow_7</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_11</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_9" sourceRef="Task_4" targetRef="
  EndEvent_3" />
<bpmn:sequenceFlow id="SequenceFlow_10" sourceRef="Task_5" targetRef="Task_7"
  />
<bpmn:sequenceFlow id="SequenceFlow_11" sourceRef="Task_6" targetRef="
  InclusiveGateway_2" />
<bpmn:boundaryEvent id="BoundaryEvent_1" name="Invitation rejection"
  attachedToRef="Task_4">
  <bpmn:outgoing>SequenceFlow_8</bpmn:outgoing>
  <bpmn:conditionalEventDefinition />
</bpmn:boundaryEvent>
<bpmn:sequenceFlow id="SequenceFlow_8" sourceRef="BoundaryEvent_1" targetRef="
  EndEvent_1" />
<bpmn:endEvent id="EndEvent_1" name="Receive invitation rejection">
  <bpmn:incoming>SequenceFlow_8</bpmn:incoming>
  <bpmn:messageEventDefinition/>
</bpmn:endEvent>

```

```

<bpmn:sequenceFlow id="SequenceFlow_12" sourceRef="InclusiveGateway_2"
  targetRef="Task_8" />
<bpmn:sequenceFlow id="SequenceFlow_13" sourceRef="InclusiveGateway_2"
  targetRef="Task_9" />
<bpmn:sequenceFlow id="SequenceFlow_14" sourceRef="InclusiveGateway_2"
  targetRef="Task_10" />
<bpmn:sequenceFlow id="SequenceFlow_15" sourceRef="Task_7" targetRef="
  EndEvent_3" />
<bpmn:task id="Task_7" name="Add user as friend">
  <bpmn:incoming>SequenceFlow_10</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_15</bpmn:outgoing>
</bpmn:task>
<bpmn:task id="Task_8" name="Answer the question">
  <bpmn:incoming>SequenceFlow_12</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_17</bpmn:outgoing>
</bpmn:task>
<bpmn:task id="Task_9" name="Add the question to favorites">
  <bpmn:incoming>SequenceFlow_13</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_18</bpmn:outgoing>
</bpmn:task>
<bpmn:task id="Task_10" name="View answerer's information">
  <bpmn:incoming>SequenceFlow_14</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_19</bpmn:outgoing>
</bpmn:task>
<bpmn:boundaryEvent id="BoundaryEvent_2" name="Invitation rejection"
  attachedToRef="Task_7">
  <bpmn:outgoing>SequenceFlow_16</bpmn:outgoing>
  <bpmn:conditionalEventDefinition />
</bpmn:boundaryEvent>
<bpmn:sequenceFlow id="SequenceFlow_16" sourceRef="BoundaryEvent_2" targetRef
  ="EndEvent_2" />
<bpmn:endEvent id="EndEvent_2" name="Receive invitation rejection">
  <bpmn:ingoing>SequenceFlow_16</bpmn:ingoing>
  <bpmn:messageEventDefinition/>
</bpmn:endEvent>
<bpmn:sequenceFlow id="SequenceFlow_17" sourceRef="Task_8" targetRef="
  EndEvent_3" />
<bpmn:sequenceFlow id="SequenceFlow_18" sourceRef="Task_9" targetRef="
  EndEvent_3" />
<bpmn:sequenceFlow id="SequenceFlow_19" sourceRef="Task_10" targetRef="
  Task_11" />
<bpmn:task id="Task_11" name="Send message">
  <bpmn:incoming>SequenceFlow_14</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_20</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_20" sourceRef="Task_11" targetRef="
  EndEvent_3" />
<bpmn:endEvent id="EndEvent_3">
  <bpmn:ingoing>SequenceFlow_9</bpmn:outgoing>
  <bpmn:ingoing>SequenceFlow_15</bpmn:outgoing>
  <bpmn:ingoing>SequenceFlow_17</bpmn:outgoing>
  <bpmn:ingoing>SequenceFlow_18</bpmn:outgoing>

```

```

    <bpmn:ingoing>SequenceFlow_20</bpmn:outgoing>
  </bpmn:endEvent>
</bpmn:process>

```

## Message Replying Service CMMN Model and XML

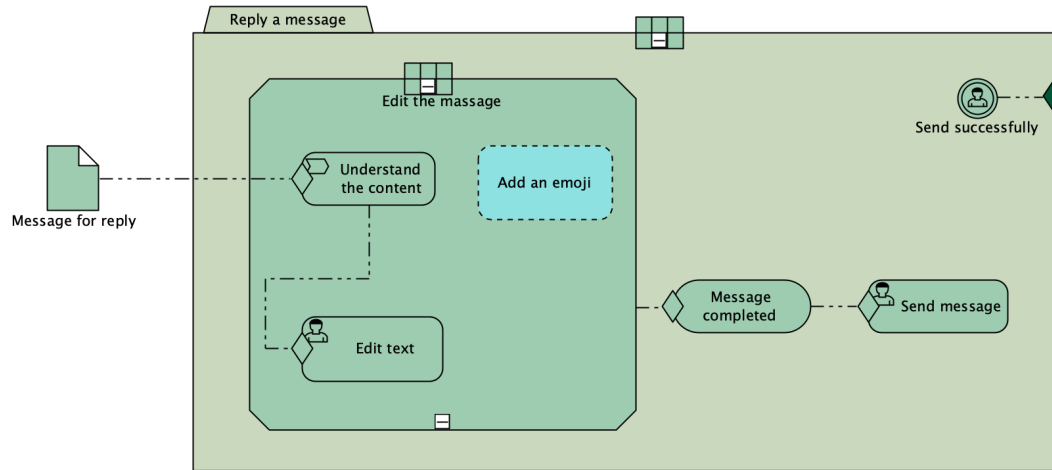


Fig. 7. Reply a Message

## Login Management Service BPMN Model and XML

```

<bpmn:process id="Process_3" isExecutable="true">
  <bpmn:task id="Task_1" name="Fill in personal information">
    <bpmn:incoming>SequenceFlow_3</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_4</bpmn:outgoing>
  </bpmn:task>
  <bpmn:startEvent id="StartEvent">
    <bpmn:outgoing>SequenceFlow_1</bpmn:outgoing>
  </bpmn:startEvent>
  <bpmn:sequenceFlow id="SequenceFlow_1" sourceRef="StartEvent"
    targetRef="ExclusiveGateway_1" />
  <bpmn:sequenceFlow id="SequenceFlow_2" sourceRef="ExclusiveGateway_1"
    targetRef="ExclusiveGateway_2" />
  <bpmn:conditionExpression
    xsi:type="bpmn:tFormalExpression">N</bpmn:conditionExpression>
  </bpmn:sequenceFlow>
  <bpmn:exclusiveGateway id="ExclusiveGateway_1" name="Wether to register">
    <bpmn:incoming>SequenceFlow_1</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_2</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_8</bpmn:outgoing>
  </bpmn:exclusiveGateway>
  <bpmn:sequenceFlow id="SequenceFlow_4" sourceRef="Task_1"
    targetRef="Task_2" />
  <bpmn:exclusiveGateway id="ExclusiveGateway_2" name="Wether have
    registered">

```

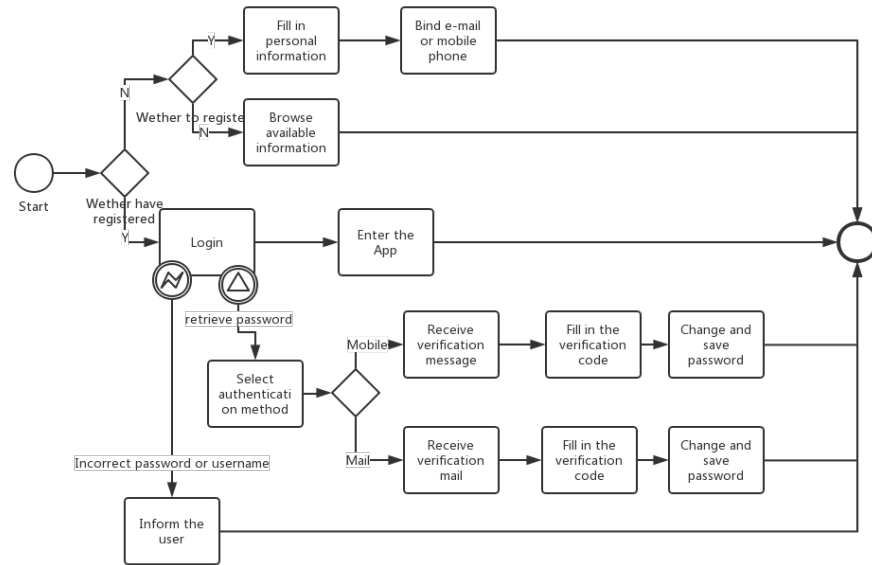


Fig. 8. Login Service

```

<bpmn:incoming>SequenceFlow_2</bpmn:incoming>
<bpmn:outgoing>SequenceFlow_3</bpmn:outgoing>
<bpmn:outgoing>SequenceFlow_6</bpmn:outgoing>
</bpmn:exclusiveGateway>
<bpmn:sequenceFlow id="SequenceFlow_3" sourceRef="ExclusiveGateway_2"
  targetRef="Task_1" >
  <bpmn:conditionExpression
    xsi:type="bpmn:tFormalExpression">Y</bpmn:
      conditionExpression>
</bpmn:sequenceFlow>
<bpmn:task id="Task_2" name="Bind e-mail or mobile phone">
  <bpmn:incoming>SequenceFlow_4</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_5</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_5" sourceRef="Task_2"
  targetRef="EndEvent"/>
<bpmn:endEvent id="EndEvent">
  <bpmn:incoming>SequenceFlow_5</bpmn:incoming>
  <bpmn:incoming>SequenceFlow_7</bpmn:incoming>
  <bpmn:incoming>SequenceFlow_12</bpmn:incoming>
  <bpmn:incoming>SequenceFlow_17</bpmn:incoming>
  <bpmn:incoming>SequenceFlow_21</bpmn:incoming>
  <bpmn:incoming>SequenceFlow_22</bpmn:incoming>
</bpmn:endEvent>
<bpmn:sequenceFlow id="SequenceFlow_6" sourceRef="ExclusiveGateway_2"

```



```

        targetRef="Task_3">
        <bpmn:conditionExpression
            xsi:type="bpmn:tFormalExpression">N</bpmn:
            conditionExpression>
    </bpmn:sequenceFlow>
    <bpmn:task id="Task_3" name="Remind users">
        <bpmn:incoming>SequenceFlow_6</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_7</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_7" sourceRef="Task_3"
        targetRef="EndEvent"/>
    <bpmn:sequenceFlow id="SequenceFlow_8" sourceRef="ExclusiveGateway_1"
        targetRef="Task_4">
        <bpmn:conditionExpression
            xsi:type="bpmn:tFormalExpression">Y</bpmn:
            conditionExpression>
    </bpmn:sequenceFlow>
    <bpmn:task id="Task_4" name="Login">
        <bpmn:incoming>SequenceFlow_8</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_11</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_11" sourceRef="Task_4"
        targetRef="Task_5" />
    <bpmn:task id="Task_5" name="Enter the App">
        <bpmn:incoming>SequenceFlow_11</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_12</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_12" sourceRef="Task_5"
        targetRef="EndEvent" />
    <bpmn:boundaryEvent id="BoundaryEvent_1" attachedToRef="Task_4">
        <bpmn:outgoing>SequenceFlow_9</bpmn:outgoing>
        <bpmn:errorEventDefinition />
    </bpmn:boundaryEvent>
    <bpmn:sequenceFlow id="SequenceFlow_9" sourceRef="BoundaryEvent_1"
        targetRef="Task_6" >
        <bpmn:conditionExpression
            xsi:type="bpmn:tFormalExpression">Incorrect password or
            username</bpmn:conditionExpression>
    </bpmn:sequenceFlow>
    <bpmn:task id="Task_6" name="Inform the user">
        <bpmn:incoming>SequenceFlow_9</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_22</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_22" sourceRef="Task_6"
        targetRef="EndEvent" />
    <bpmn:boundaryEvent id="BoundaryEvent_2" attachedToRef="Task_4">
        <bpmn:outgoing>SequenceFlow_10</bpmn:outgoing>
        <bpmn:signalEventDefinition />
    </bpmn:boundaryEvent>
    <bpmn:sequenceFlow id="SequenceFlow_10" sourceRef="BoundaryEvent_2"
        targetRef="Task_7" >
        <bpmn:conditionExpression

```

```

        xsi:type="bpmn:tFormalExpression">retrieve password</bpmn:
        conditionExpression>
</bpmn:sequenceFlow>
<bpmn:task id="Task_7" name="Select authentication method">
    <bpmn:incoming>SequenceFlow_10</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_13</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_13" sourceRef="Task_7"
    targetRef="ExclusiveGateway_3" />
<bpmn:exclusiveGateway id="ExclusiveGateway_3">
    <bpmn:incoming>SequenceFlow_13</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_14</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_18</bpmn:outgoing>
</bpmn:exclusiveGateway>
<bpmn:sequenceFlow id="SequenceFlow_14" sourceRef="ExclusiveGateway_3"
    targetRef="Task_8" >
    <bpmn:conditionExpression
        xsi:type="bpmn:tFormalExpression">Mobile</bpmn:
        conditionExpression>
</bpmn:sequenceFlow>
<bpmn:task id="Task_8" name="Receive verification message">
    <bpmn:incoming>SequenceFlow_14</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_15</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_15" sourceRef="Task_8"
    targetRef="Task_9" />
<bpmn:task id="Task_9" name="Fill in the verification code">
    <bpmn:incoming>SequenceFlow_15</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_16</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_16" sourceRef="Task_9"
    targetRef="Task_10" />
<bpmn:task id="Task_10" name="Change and save password">
    <bpmn:incoming>SequenceFlow_16</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_17</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_17" sourceRef="Task_10"
    targetRef="EndEvent" />
<bpmn:sequenceFlow id="SequenceFlow_18" sourceRef="ExclusiveGateway_3"
    targetRef="Task_11" >
    <bpmn:conditionExpression xsi:type="bpmn:tFormalExpression">Mail</
    bpmn:conditionExpression>
</bpmn:sequenceFlow>
<bpmn:task id="Task_11" name="Receive verification mail">
    <bpmn:incoming>SequenceFlow_18</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_19</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_19" sourceRef="Task_11"
    targetRef="Task_12" />
<bpmn:task id="Task_12" name="Fill in the verification code">
    <bpmn:incoming>SequenceFlow_19</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_20</bpmn:outgoing>

```

```
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_20" sourceRef="Task_12"
    targetRef="Task_13" />
<bpmn:task id="Task_13" name="Change and save password">
    <bpmn:incoming>SequenceFlow_20</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_21</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_21" sourceRef="Task_13"
    targetRef="EndEvent" />
</bpmn:process>
```

## Study Plan Management Service BPMN Model and XML

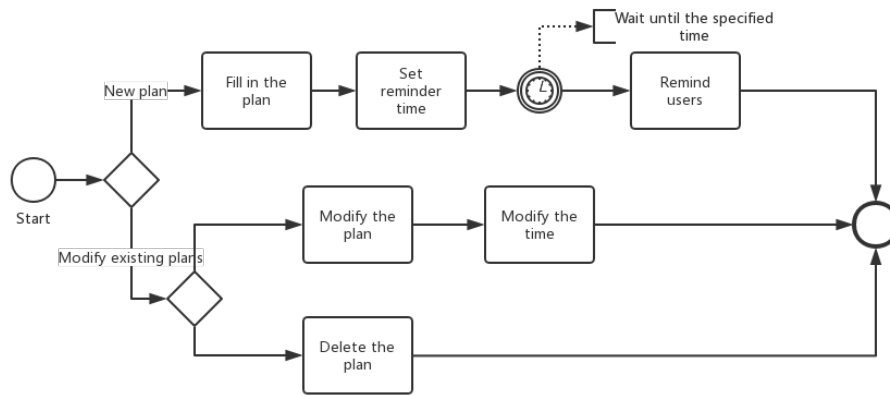


Fig. 9. Study Plan Service

```

    <bpmn:process id="Process_2" isExecutable="true">
<bpmn:task id="Task_1" name="Fill in the plan">
  <bpmn:incoming>SequenceFlow_2</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_3</bpmn:outgoing>
</bpmn:task>
<bpmn:startEvent id="StartEvent">
  <bpmn:outgoing>SequenceFlow_1</bpmn:outgoing>
</bpmn:startEvent>
<bpmn:sequenceFlow id="SequenceFlow_1" sourceRef="StartEvent"
  targetRef="ExclusiveGateway_1" />
<bpmn:sequenceFlow id="SequenceFlow_2" sourceRef="ExclusiveGateway_1"
  targetRef="Task_1">
  <bpmn:conditionExpression
    xsi:type="bpmn:tFormalExpression">New plan</bpmn:conditionExpression>
</bpmn:sequenceFlow>
<bpmn:exclusiveGateway id="ExclusiveGateway_1">
  <bpmn:incoming>SequenceFlow_1</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_2</bpmn:outgoing>
  <bpmn:outgoing>SequenceFlow_7</bpmn:outgoing>
</bpmn:exclusiveGateway>
<bpmn:sequenceFlow id="SequenceFlow_3" sourceRef="Task_1"
  targetRef="Task_2" />
<bpmn:sequenceFlow id="SequenceFlow_7" sourceRef="ExclusiveGateway_1"
  targetRef="ExclusiveGateway_2">
  <bpmn:conditionExpression
    xsi:type="bpmn:tFormalExpression">Modify existing plans</bpmn:
    conditionExpression>
</bpmn:sequenceFlow>

```

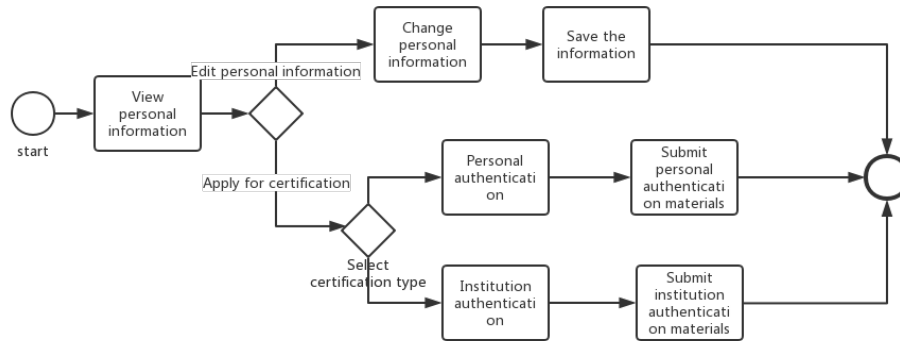
```

<bpmn:task id="Task_2" name="Set reminder time">
  <bpmn:incoming>SequenceFlow_3</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_4</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_4" sourceRef="Task_2"
  targetRef="IntermediateCatchEvent"/>
<bpmn:intermediateCatchEvent id="IntermediateCatchEvent">
  <bpmn:incoming>SequenceFlow_4</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_5</bpmn:outgoing>
  <bpmn:timeEventDefinition />
</bpmn:intermediateCatchEvent>
<bpmn:sequenceFlow id="SequenceFlow_5" sourceRef="IntermediateCatchEvent"
  targetRef="Task_3"/>
<bpmn:task id="Task_3" name="Remind users">
  <bpmn:incoming>SequenceFlow_5</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_6</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_6" sourceRef="Task_3"
  targetRef="EndEvent"/>
<bpmn:endEvent id="EndEvent">
  <bpmn:incoming>SequenceFlow_6</bpmn:incoming>
  <bpmn:incoming>SequenceFlow_10</bpmn:incoming>
  <bpmn:incoming>SequenceFlow_12</bpmn:incoming>
</bpmn:endEvent>
<bpmn:exclusiveGateway id="ExclusiveGateway_2">
  <bpmn:incoming>SequenceFlow_7</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_8</bpmn:outgoing>
  <bpmn:outgoing>SequenceFlow_11</bpmn:outgoing>
</bpmn:exclusiveGateway>
<bpmn:sequenceFlow id="SequenceFlow_8" sourceRef="ExclusiveGateway_2"
  targetRef="Task_4" />
<bpmn:task id="Task_4" name="Modify the plan">
  <bpmn:incoming>SequenceFlow_8</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_9</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_9" sourceRef="Task_4"
  targetRef="Task_5" />
<bpmn:task id="Task_5" name="Modify the time">
  <bpmn:incoming>SequenceFlow_9</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_10</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_10" sourceRef="Task_5"
  targetRef="EndEvent" />
<bpmn:sequenceFlow id="SequenceFlow_11" sourceRef="ExclusiveGateway_2"
  targetRef="Task_6" />
<bpmn:task id="Task_6" name="Delete the plan">
  <bpmn:incoming>SequenceFlow_11</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_12</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_12" sourceRef="Task_6"
  targetRef="EndEvent" />
<bpmn:textAnnotation id="TextAnnotation_1">

```

```
    <bpmn:text>Wait until the specified time</bpmn:text>
  </bpmn:textAnnotation>
  <bpmn:association id="Association_1" sourceRef="IntermediateCatchEvent"
    targetRef="TextAnnotation_1" />
</bpmn:process>
```

## Personal data management Service BPMN Model and XML



```

<bpmn:process id="Process_1" isExecutable="true">
  <bpmn:task id="Task_1" name="View personal information">
    <bpmn:incoming>SequenceFlow_1</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_2</bpmn:outgoing>
  </bpmn:task>
  <bpmn:startEvent id="StartEvent">
    <bpmn:outgoing>SequenceFlow_1</bpmn:outgoing>
  </bpmn:startEvent>
  <bpmn:sequenceFlow id="SequenceFlow_1" sourceRef="StartEvent"
    targetRef="Task_1" />
  <bpmn:sequenceFlow id="SequenceFlow_2" sourceRef="Task_1"
    targetRef="ExclusiveGateway_1" />
  <bpmn:exclusiveGateway id="ExclusiveGateway_1">
    <bpmn:incoming>SequenceFlow_2</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_3</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_6</bpmn:outgoing>
  </bpmn:exclusiveGateway>
  <bpmn:task id="Task_2" name="Change personal information">
    <bpmn:incoming>SequenceFlow_3</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_4</bpmn:outgoing>
  </bpmn:task>
  <bpmn:sequenceFlow id="SequenceFlow_4" sourceRef="Task_2"
    targetRef="Task_3" />
  <bpmn:task id="Task_3" name="Save the information">
    <bpmn:incoming>SequenceFlow_4</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_5</bpmn:outgoing>
  </bpmn:task>
  <bpmn:sequenceFlow id="SequenceFlow_5" sourceRef="Task_3"
    targetRef="EndEvent" />
  <bpmn:sequenceFlow id="SequenceFlow_6" sourceRef="Task_1"
    targetRef="ExclusiveGateway_1" />
  <bpmn:task id="Task_4" name="Personal authentication">
    <bpmn:incoming>SequenceFlow_6</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_7</bpmn:outgoing>
  </bpmn:task>
  <bpmn:task id="Task_5" name="Submit personal authentication on materials">
    <bpmn:incoming>SequenceFlow_7</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_8</bpmn:outgoing>
  </bpmn:task>
  <bpmn:task id="Task_6" name="Institution authentication">
    <bpmn:incoming>SequenceFlow_6</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_9</bpmn:outgoing>
  </bpmn:task>
  <bpmn:task id="Task_7" name="Submit institution authentication on materials">
    <bpmn:incoming>SequenceFlow_9</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_10</bpmn:outgoing>
  </bpmn:task>
  <bpmn:endEvent id="EndEvent">
    <bpmn:incoming>SequenceFlow_5</bpmn:incoming>
    <bpmn:incoming>SequenceFlow_8</bpmn:incoming>
    <bpmn:incoming>SequenceFlow_10</bpmn:incoming>
  </bpmn:endEvent>
</bpmn:process>
  
```

```

<bpmn:endEvent id="EndEvent">
  <bpmn:incoming>SequenceFlow_5</bpmn:incoming>
  <bpmn:incoming>SequenceFlow_9</bpmn:incoming>
  <bpmn:incoming>SequenceFlow_12</bpmn:incoming>
</bpmn:endEvent>
<bpmn:sequenceFlow id="SequenceFlow_9" sourceRef="Task_5"
  targetRef="EndEvent" />
<bpmn:sequenceFlow id="SequenceFlow_12" sourceRef="Task_7"
  targetRef="EndEvent" />
<bpmn:sequenceFlow id="SequenceFlow_3" sourceRef="ExclusiveGateway_1"
  targetRef="Task_2">
  <bpmn:conditionExpression
    xsi:type="bpmn:tFormalExpression">Edit personal information</bpmn:
    conditionExpression>
</bpmn:sequenceFlow>
<bpmn:sequenceFlow id="SequenceFlow_6" sourceRef="ExclusiveGateway_1"
  targetRef="ExclusiveGateway_2">
  <bpmn:conditionExpression
    xsi:type="bpmn:tFormalExpression">Apply for certification</bpmn:
    conditionExpression>
</bpmn:sequenceFlow>
<bpmn:exclusiveGateway id="ExclusiveGateway_2">
  <bpmn:incoming>SequenceFlow_6</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_7</bpmn:outgoing>
  <bpmn:outgoing>SequenceFlow_10</bpmn:outgoing>
</bpmn:exclusiveGateway>
<bpmn:sequenceFlow id="SequenceFlow_7" sourceRef="ExclusiveGateway_2"
  targetRef="Task_4" />
<bpmn:sequenceFlow id="SequenceFlow_10" sourceRef="ExclusiveGateway_2"
  targetRef="Task_6" />
<bpmn:task id="Task_4" name="Personal authentication">
  <bpmn:incoming>SequenceFlow_7</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_8</bpmn:outgoing>
</bpmn:task>
<bpmn:task id="Task_6" name="Institution authentication">
  <bpmn:incoming>SequenceFlow_10</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_11</bpmn:outgoing>
</bpmn:task>
<bpmn:sequenceFlow id="SequenceFlow_8" sourceRef="Task_4"
  targetRef="Task_5" />
<bpmn:sequenceFlow id="SequenceFlow_11" sourceRef="Task_6"
  targetRef="Task_7" />
<bpmn:task id="Task_5" name="Submit personal authentication materials">
  <bpmn:incoming>SequenceFlow_8</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_9</bpmn:outgoing>
</bpmn:task>
<bpmn:task id="Task_7" name="Submit institution authentication materials">
  <bpmn:incoming>SequenceFlow_11</bpmn:incoming>
  <bpmn:outgoing>SequenceFlow_12</bpmn:outgoing>
</bpmn:task>
</bpmn:process>

```



## Learning Report Service CMMN Model and XML

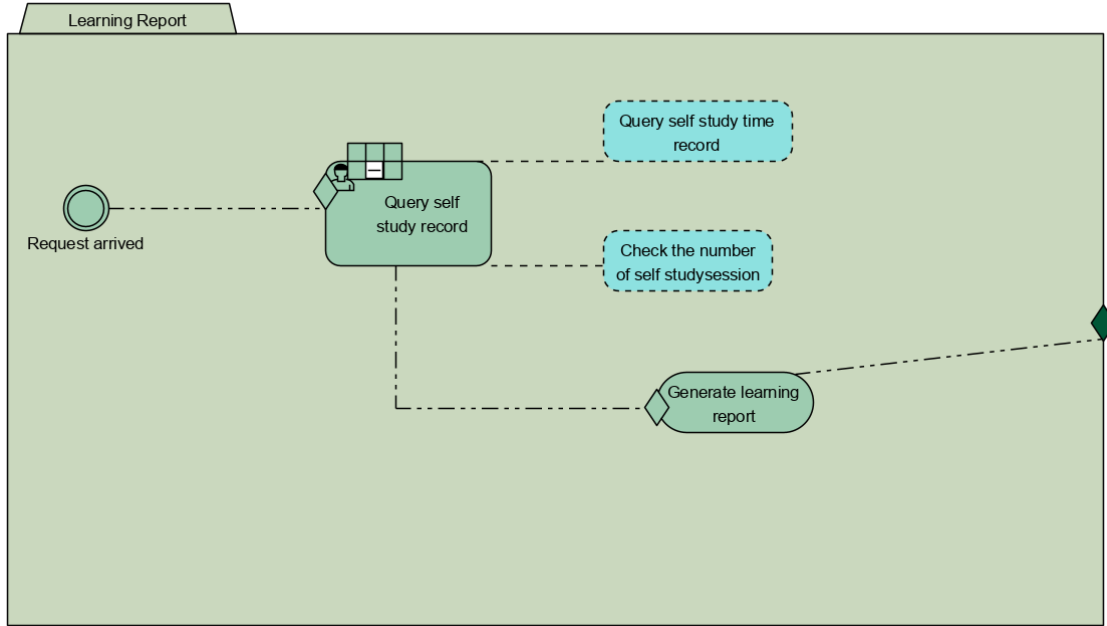


Fig. 10. Learning Report Service CMMN Model

```

<cmmn:case id="Case_1">
  <cmmn:casePlanModel id="CasePlanModel_1" name="Learning Report">
    <cmmn:planItem id="PlanItem_1" name="wait for request" definitionRef="
      TimerEventListener" />
    <cmmn:humanTask id="HumanTask_1" name="Task A">
      <cmmn:entryCriterion id="EntryCriterion_1" sentryRef="Sentry_1" />
      <cmmn:planningTable id="PlanningTable_1">
        <cmmn:discretionaryItem id="DiscretionaryItem_1" definitionRef="
          HumanTask_2"/>
        <cmmn:discretionaryItem id="DiscretionaryItem_2" definitionRef="
          HumanTask_3"/>
      </cmmn:planningTable>
    </cmmn:humanTask>
    <cmmn:sentry id="Sentry_1">
      <cmmn:planItemOnPart id="PlanItemOnPart_1" sourceRef="PlanItem_1">
        <cmmn:standardEvent>complete</cmmn:standardEvent>
      </cmmn:planItemOnPart>
    </cmmn:sentry>
    <cmmn:sentry id="Sentry_2">
      <cmmn:planItemOnPart id="PlanItemOnPart_1" sourceRef="PlanItem_1">
        <cmmn:standardEvent>complete</cmmn:standardEvent>
      </cmmn:planItemOnPart>
    </cmmn:sentry>
  </cmmn:casePlanModel>
</cmmn:case>
  
```

```
<cmmn:sentry id="Sentry_3">
  <cmmn:planItemOnPart id="PlanItemOnPart_1" sourceRef="PlanItem_1">
    <cmmn:standardEvent>complete</cmmn:standardEvent>
  </cmmn:planItemOnPart>
</cmmn:sentry>
<cmmn:milestone id="Milestone_One" name="Milestone One">
  <cmmn:entryCriterion id="EntryCriterion_2" sentryRef="Sentry_2" />
</cmmn:milestone>
</cmmn:casePlanModel>
</cmmn:case>
```

## Self-study Room Service BPMN Model and XML

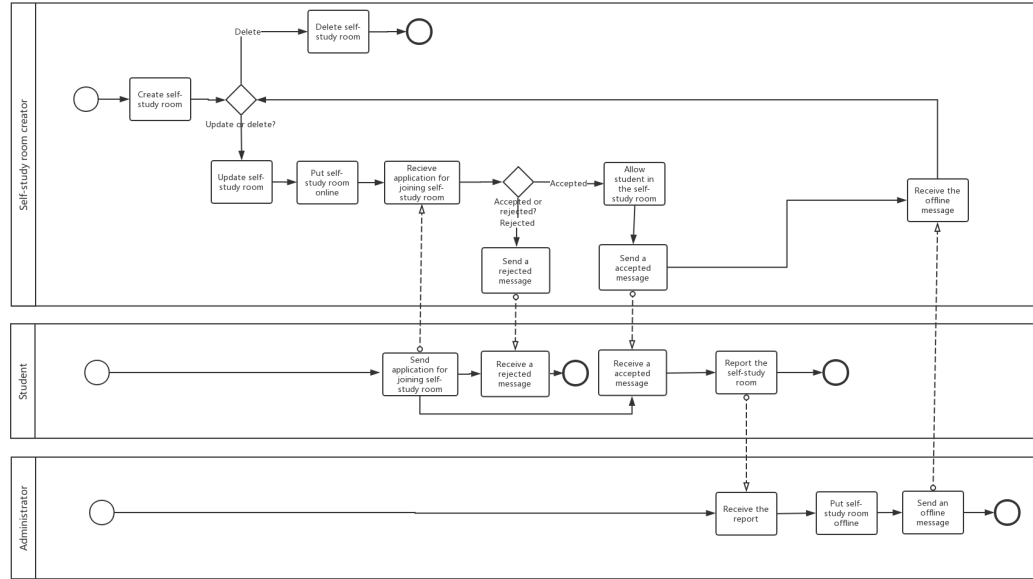


Fig. 11. Self-study Room Service BPMN Model

```
<bpmn:collaboration id="Collaboration_1">
  <bpmn:participant id="Participant_1" processRef="Process_1"/>
  <bpmn:participant id="Participant_2" processRef="Process_2"/>
  <bpmn:messageFlow id="MessageFlow_1" sourceRef="Participant_2"
    targetRef="Participant_1"/>
</bpmn:collaboration>
<bpmn:collaboration id="Collaboration_2">
  <bpmn:participant id="Participant_1" processRef="Process_1"/>
  <bpmn:participant id="Participant_2" processRef="Process_2"/>
  <bpmn:messageFlow id="MessageFlow_2" sourceRef="Participant_1"
    targetRef="Participant_2"/>
</bpmn:collaboration>
<bpmn:collaboration id="Collaboration_3">
  <bpmn:participant id="Participant_1" processRef="Process_1"/>
  <bpmn:participant id="Participant_2" processRef="Process_2"/>
  <bpmn:messageFlow id="MessageFlow_3" sourceRef="Participant_1"
    targetRef="Participant_2"/>
</bpmn:collaboration>
<bpmn:collaboration id="Collaboration_4">
  <bpmn:participant id="Participant_3" processRef="Process_3"/>
  <bpmn:participant id="Participant_2" processRef="Process_2"/>
  <bpmn:messageFlow id="MessageFlow_4" sourceRef="Participant_2"
    targetRef="Participant_3"/>
</bpmn:collaboration>
```

```

</bpmn:collaboration>
<bpmn:collaboration id="Collaboration_5">
  <bpmn:participant id="Participant_3" processRef="Process_3"/>
  <bpmn:participant id="Participant_1" processRef="Process_1"/>
  <bpmn:messageFlow id="MessageFlow_5" sourceRef="Participant_3"
    targetRef="Participant_1"/>
</bpmn:collaboration>
<bpmn:process id="Process_1" isExecutable="true">
  <bpmn:startEvent id="StartEvent_1">
    <bpmn:outgoing>SequenceFlow_1</bpmn:outgoing>
  </bpmn:startEvent>
  <bpmn:task id="Task_1" name="Create self-study room">
    <bpmn:incoming>SequenceFlow_1</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_2</bpmn:outgoing>
  </bpmn:task>
  <bpmn:sequenceFlow id="SequenceFlow_1" sourceRef="StartEvent_1"
    targetRef="Task_1" />
  <bpmn:exclusiveGateway id="ExclusiveGateway_1">
    <bpmn:incoming>SequenceFlow_2</bpmn:incoming>
    <bpmn:incoming>SequenceFlow_6</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_3</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_5</bpmn:outgoing>
  </bpmn:exclusiveGateway>
  <bpmn:sequenceFlow id="SequenceFlow_2" sourceRef="Task_1"
    targetRef="ExclusiveGateway_1" />
  <bpmn:task id="Task_2" name="Delete self-study room">
    <bpmn:incoming>SequenceFlow_3</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_4</bpmn:outgoing>
  </bpmn:task>
  <bpmn:sequenceFlow id="SequenceFlow_3" sourceRef="
    ExclusiveGateway_1"
    targetRef="Task_2">
    <bpmn:conditionExpression
      xsi:type="bpmn:tFormalExpression">Delete</bpmn:
        conditionExpression>
    </bpmn:sequenceFlow>
  <bpmn:endEvent id="EndEvent_1">
    <bpmn:incoming>SequenceFlow_4</bpmn:incoming>
  </bpmn:endEvent>
  <bpmn:sequenceFlow id="SequenceFlow_4" sourceRef="Task_2"
    targetRef="EndEvent_1" />
  <bpmn:task id="Task_3" name="Update self-study room">
    <bpmn:incoming>SequenceFlow_5</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_7</bpmn:outgoing>
  </bpmn:task>
  <bpmn:sequenceFlow id="SequenceFlow_5" sourceRef="
    ExclusiveGateway_1"
    targetRef="Task_3">
    <bpmn:conditionExpression
      xsi:type="bpmn:tFormalExpression">Update</bpmn:
        conditionExpression>
    </bpmn:sequenceFlow>

```

```

        <bpmn:task id="Task_4" name="Put self-study room online">
        <bpmn:incoming>SequenceFlow_7</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_8</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_7" sourceRef="Task_3"
    targetRef="Task_4" />
    <bpmn:task id="Task_5" name="Recieve application for joining self-
    study room">
    <bpmn:incoming>SequenceFlow_8</bpmn:incoming>
        <bpmn:incoming>MessageFlow_1</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_9</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_8" sourceRef="Task_4"
    targetRef="Task_5" />
    <bpmn:exclusiveGateway id="ExclusiveGateway_2">
        <bpmn:incoming>SequenceFlow_9</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_10</bpmn:outgoing>
        <bpmn:outgoing>SequenceFlow_11</bpmn:outgoing>
    </bpmn:exclusiveGateway>
    <bpmn:sequenceFlow id="SequenceFlow_9" sourceRef="Task_5"
    targetRef="ExclusiveGateway_2" />
    <bpmn:task id="Task_7" name="Allow student in the self-study room"
    >
    <bpmn:incoming>SequenceFlow_10</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_12</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_10" sourceRef="
    ExclusiveGateway_2"
        targetRef="Task_7">
        <bpmn:conditionExpression
            xsi:type="bpmn:tFormalExpression">Accepted</bpmn:
            conditionExpression>
        </bpmn:sequenceFlow>
    <bpmn:task id="Task_6" name="Send a rejected message">
    <bpmn:incoming>SequenceFlow_11</bpmn:incoming>
    <bpmn:outgoing>MessageFlow_2</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_11" sourceRef="
    ExclusiveGateway_2"
        targetRef="Task_6">
        <bpmn:conditionExpression
            xsi:type="bpmn:tFormalExpression">Rejected</bpmn:
            conditionExpression>
        </bpmn:sequenceFlow>
    <bpmn:task id="Task_8" name="Send a accepted message">
    <bpmn:incoming>SequenceFlow_12</bpmn:incoming>
    <bpmn:outgoing>MessageFlow_3</bpmn:outgoing>
        <bpmn:outgoing>SequenceFlow_13</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_12" sourceRef="Task_7"
    targetRef="Task_8" />
    <bpmn:task id="Task_9" name="Receive the offline message">

```

```

        <bpmn:incoming>SequenceFlow_13</bpmn:incoming>
        <bpmn:incoming>MessageFlow_5</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_6</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_13" sourceRef="Task_8"
        targetRef="Task_9" />
    <bpmn:sequenceFlow id="SequenceFlow_6" sourceRef="Task_9"
        targetRef="ExclusiveGateway_1" />
</bpmn:process>
<bpmn:process id="Process_2" isExecutable="true">
    <bpmn:startEvent id="StartEvent_2">
        <bpmn:outgoing>SequenceFlow_14</bpmn:outgoing>
    </bpmn:startEvent>
    <bpmn:task id="Task_10" name="Send application for joining self-
        study room">
        <bpmn:incoming>SequenceFlow_14</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_15</bpmn:outgoing>
        <bpmn:outgoing>SequenceFlow_17</bpmn:outgoing>
        <bpmn:outgoing>MessageFlow_1</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_14" sourceRef="StartEvent_2"
        targetRef="Task_10" />
    <bpmn:task id="Task_11" name="Receive a rejected message">
        <bpmn:incoming>SequenceFlow_15</bpmn:incoming>
        <bpmn:incoming>MessageFlow_2</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_16</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_15" sourceRef="Task_10"
        targetRef="Task_11" />
    <bpmn:endEvent id="EndEvent_2">
        <bpmn:incoming>SequenceFlow_16</bpmn:incoming>
    </bpmn:endEvent>
    <bpmn:sequenceFlow id="SequenceFlow_15" sourceRef="Task_11"
        targetRef="EndEvent_2" />
    <bpmn:task id="Task_12" name="Receive a accepted message">
        <bpmn:incoming>SequenceFlow_17</bpmn:incoming>
        <bpmn:incoming>MessageFlow_3</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_18</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_17" sourceRef="Task_10"
        targetRef="Task_12" />
    <bpmn:task id="Task_13" name="Report the self-study room">
        <bpmn:incoming>SequenceFlow_18</bpmn:incoming>
        <bpmn:outgoing>MessageFlow_4</bpmn:outgoing>
        <bpmn:outgoing>SequenceFlow_19</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_18" sourceRef="Task_12"
        targetRef="Task_13" />
    <bpmn:endEvent id="EndEvent_3">
        <bpmn:incoming>SequenceFlow_19</bpmn:incoming>
    </bpmn:endEvent>
    <bpmn:sequenceFlow id="SequenceFlow_19" sourceRef="Task_13"

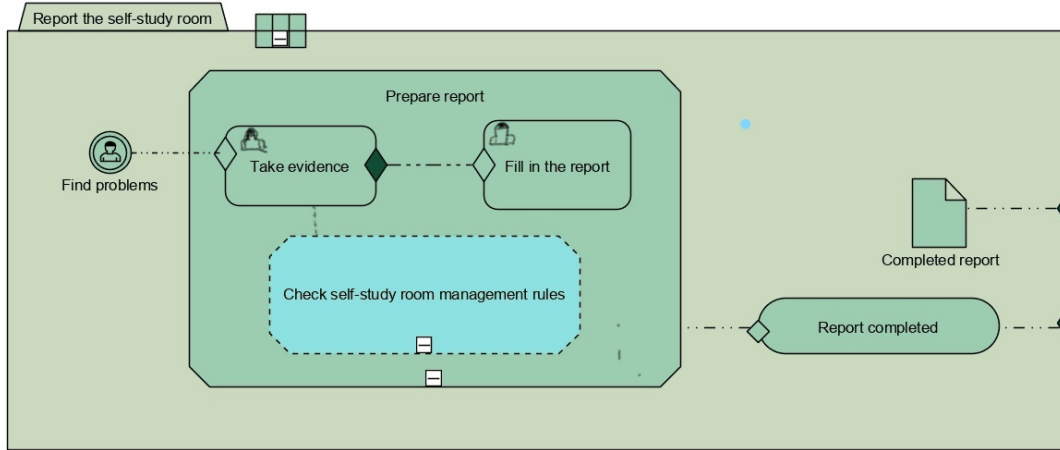
```

```

        targetRef="EndEvent_3" />
</bpmn:process>
<bpmn:process id="Process_3" isExecutable="true">
    <bpmn:startEvent id="StartEvent_3">
        <bpmn:outgoing>SequenceFlow_20</bpmn:outgoing>
    </bpmn:startEvent>
    <bpmn:task id="Task_14" name="Receive the report">
        <bpmn:incoming>SequenceFlow_20</bpmn:incoming>
        <bpmn:incoming>MessageFlow_4</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_21</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_20" sourceRef="StartEvent_3"
        targetRef="Task_14" />
    <bpmn:task id="Task_15" name="Put self-study room offline">
        <bpmn:incoming>SequenceFlow_21</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_22</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_21" sourceRef="Task_14"
        targetRef="Task_15" />
    <bpmn:task id="Task_16" name="Send an offline message">
        <bpmn:incoming>SequenceFlow_22</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_23</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_22" sourceRef="Task_15"
        targetRef="Task_16" />
    <bpmn:endEvent id="EndEvent_4">
        <bpmn:incoming>SequenceFlow_23</bpmn:incoming>
    </bpmn:endEvent>
    <bpmn:sequenceFlow id="SequenceFlow_23" sourceRef="Task_16"
        targetRef="EndEvent_4" />
</bpmn:process>

```

## Report the Self-study Room Service CMMN Model and XML



**Fig. 12.** Report the Self-study Room Service CMMN Model

```

<cmmn:case id="Case_1">
  <cmmn:casePlanModel id="CasePlanModel_1" name="Report the self-
    study room">
    <cmmn:planItem id="PlanItem_3" name="Find problems" definitionRef=
      "UserEventListener_1"/>
    <cmmn:planItem id="PlanItem_4" definitionRef="Milestone_1"/>
    <cmmn:stage id="Stage_A" name="Prepare report">
      <cmmn:planItem id="PlanItem_1" definitionRef="HumanTask_A"
        />
      <cmmn:planItem id="PlanItem_2" definitionRef="HumanTask_B"
        />
      <cmmn:sentry id="Sentry_1">
        <cmmn:planItemOnPart id="PlanItemOnPart_1" sourceRef
          ="PlanItem_3">
          <cmmn:standardEvent>occur</cmmn:standardEvent>
        </cmmn:planItemOnPart>
      </cmmn:sentry>
      <cmmn:exitCriterion id="ExitCriterion_1" sentryRef="
        Sentry_2" />
      <cmmn:sentry id="Sentry_2">
        <cmmn:planItemOnPart id="PlanItemOnPart_2" sourceRef
          ="PlanItem_2">
          <cmmn:standardEvent>occur</cmmn:standardEvent>
        </cmmn:planItemOnPart>
      </cmmn:sentry>
    </cmmn:stage>
  </cmmn:casePlanModel>
</cmmn:case>

```



```

    <cmmn:humanTask id="HumanTask_A" name="Take evidence"
      isBlocking="true">
      <cmmn:planningTable id="PlanningTable_1">
        <cmmn:discretionaryItem id="
          DiscretionaryItem_1" definitionRef="Check
            self-study room management rules" />
      </cmmn:planningTable>
    </cmmn:humanTask>
    <cmmn:humanTask id="HumanTask_B" name="Fill in the report"
      isBlocking="true" />
  </cmmn:stage>
  <cmmn:exitCriterion id="ExitCriterion_2" sentryRef="Sentry_3" />
  <cmmn:milestone id="Milestone_1" name="Report completed" />
  <cmmn:sentry id="Sentry_3">
    <cmmn:planItemOnPart id="PlanItemOnPart_3" sourceRef="
      Stage_A">
      <cmmn:standardEvent>complete</cmmn:standardEvent>
    </cmmn:planItemOnPart>
  </cmmn:sentry>
</cmmn:case>

```

## Attendance Service BPMN Model and XML

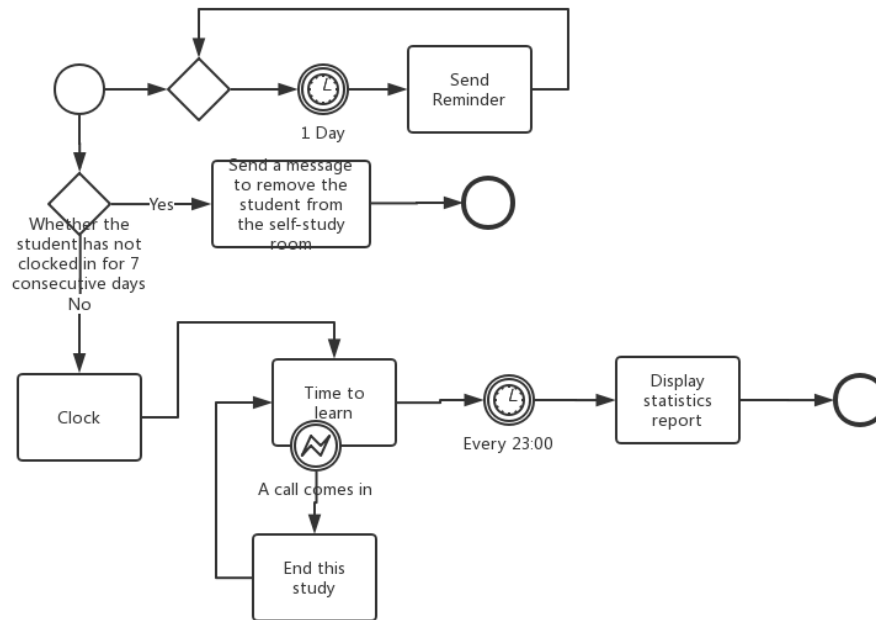


Fig. 13. Attendance Service BPMN Model

```
<bpmn:process id="Process_2" isExecutable="true">
  <bpmn:startEvent id="StartEvent_1">
    <bpmn:outgoing>SequenceFlow_1</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_5</bpmn:outgoing>
  </bpmn:startEvent>
  <bpmn:exclusiveGateway id="ExclusiveGateway_1">
    <bpmn:incoming>SequenceFlow_1</bpmn:incoming>
    <bpmn:incoming>SequenceFlow_4</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_2</bpmn:outgoing>
  </bpmn:exclusiveGateway>
  <bpmn:sequenceFlow id="SequenceFlow_1" sourceRef="StartEvent_1"
    targetRef="ExclusiveGateway_1" />
  <bpmn:intermediateCatchEvent id="IntermediateCatchEvent_1">
    <bpmn:incoming>SequenceFlow_2</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_3</bpmn:outgoing>
    <bpmn:timerEventDefinition />
  </bpmn:intermediateCatchEvent>
  <bpmn:task id="Clock">
    <bpmn:outgoing>SequenceFlow_4</bpmn:outgoing>
  </bpmn:task>
  <bpmn:task id="Time to learn">
    <bpmn:outgoing>SequenceFlow_3</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_6</bpmn:outgoing>
  </bpmn:task>
  <bpmn:task id="Send a message to remove the student from the self-study room">
    <bpmn:outgoing>SequenceFlow_5</bpmn:outgoing>
  </bpmn:task>
  <bpmn:task id="End this study">
    <bpmn:outgoing>SequenceFlow_6</bpmn:outgoing>
  </bpmn:task>
  <bpmn:task id="Send Reminder">
    <bpmn:outgoing>SequenceFlow_4</bpmn:outgoing>
  </bpmn:task>
  <bpmn:task id="Display statistics report">
    <bpmn:outgoing>SequenceFlow_2</bpmn:outgoing>
  </bpmn:task>
</bpmn:process>
```

```

        </bpmn:intermediateCatchEvent>
        <bpmn:sequenceFlow id="SequenceFlow_2" sourceRef="
            ExclusiveGateway_1"
            targetRef="IntermediateCatchEvent_1" />
        <bpmn:task id="Task_1" name="Send Reminder">
        <bpmn:incoming>SequenceFlow_3</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_4</bpmn:outgoing>
    </bpmn:task>
        <bpmn:sequenceFlow id="SequenceFlow_3" sourceRef="
            IntermediateCatchEvent_1"
            targetRef="Task_1" />
        <bpmn:sequenceFlow id="SequenceFlow_4" sourceRef="Task_1"
            targetRef="ExclusiveGateway_1" />
        <bpmn:exclusiveGateway id="ExclusiveGateway_2">
            <bpmn:incoming>SequenceFlow_5</bpmn:incoming>
            <bpmn:outgoing>SequenceFlow_6</bpmn:outgoing>
            <bpmn:outgoing>SequenceFlow_7</bpmn:outgoing>
        </bpmn:exclusiveGateway>
        <bpmn:sequenceFlow id="SequenceFlow_5" sourceRef="StartEvent_1"
            targetRef="ExclusiveGateway_2" />
        <bpmn:task id="Task_2" name="Send a message to remove the student
            from the self-study room">
        <bpmn:incoming>SequenceFlow_6</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_8</bpmn:outgoing>
    </bpmn:task>
        <bpmn:sequenceFlow id="SequenceFlow_6" sourceRef="
            ExclusiveGateway_2"
            targetRef="Task_2">
        <bpmn:conditionExpression
            xsi:type="bpmn:tFormalExpression">Yes</bpmn:
            conditionExpression>
        </bpmn:sequenceFlow>
        <bpmn:endEvent id="EndEvent_1">
            <bpmn:incoming>SequenceFlow_8</bpmn:incoming>
        </bpmn:endEvent>
        <bpmn:sequenceFlow id="SequenceFlow_8" sourceRef="Task_2"
            targetRef="EndEvent_1" />
        <bpmn:task id="Task_3" name="Clock">
        <bpmn:incoming>SequenceFlow_7</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_9</bpmn:outgoing>
    </bpmn:task>
        <bpmn:sequenceFlow id="SequenceFlow_7" sourceRef="
            ExclusiveGateway_2"
            targetRef="Task_3">
        <bpmn:conditionExpression
            xsi:type="bpmn:tFormalExpression">No</bpmn:
            conditionExpression>
        </bpmn:sequenceFlow>
        <bpmn:task id="Task_4" name="Time to learn">
        <bpmn:incoming>SequenceFlow_9</bpmn:incoming>
            <bpmn:incoming>SequenceFlow_11</bpmn:incoming>
        <bpmn:outgoing>SequenceFlow_12</bpmn:outgoing>
    </bpmn:task>

```

```

</bpmn:task>
  <bpmn:sequenceFlow id="SequenceFlow_9" sourceRef="Task_3"
    targetRef="Task_4" />
  <bpmn:boundaryEvent id="BoundaryEvent_1" attachedToRef="Task_4">
    <bpmn:outgoing>SequenceFlow_10</bpmn:outgoing>
    <bpmn:errorEventDefinition />
  </bpmn:boundaryEvent>
  <bpmn:task id="Task_5" name="End this study">
    <bpmn:incoming>SequenceFlow_10</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_11</bpmn:outgoing>
  </bpmn:task>
  <bpmn:sequenceFlow id="SequenceFlow_10" sourceRef="BoundaryEvent_1"
    targetRef="Task_5" />
  <bpmn:sequenceFlow id="SequenceFlow_11" sourceRef="Task_5"
    targetRef="Task_4" />
  <bpmn:intermediateCatchEvent id="IntermediateCatchEvent_2">
    <bpmn:incoming>SequenceFlow_12</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_13</bpmn:outgoing>
    <bpmn:timerEventDefinition />
  </bpmn:intermediateCatchEvent>
  <bpmn:sequenceFlow id="SequenceFlow_12" sourceRef="Task_4"
    targetRef="IntermediateCatchEvent_2" />
  <bpmn:task id="Task_6" name="Display statistics report">
    <bpmn:incoming>SequenceFlow_13</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_14</bpmn:outgoing>
  </bpmn:task>
  <bpmn:sequenceFlow id="SequenceFlow_13" sourceRef="
    IntermediateCatchEvent_2"
    targetRef="Task_6" />
  <bpmn:endEvent id="EndEvent_2">
    <bpmn:incoming>SequenceFlow_14</bpmn:incoming>
  </bpmn:endEvent>
  <bpmn:sequenceFlow id="SequenceFlow_14" sourceRef="Task_6"
    targetRef="EndEvent_2" />
</bpmn:process>

```

## Learning Task Service BPMN Model and XML

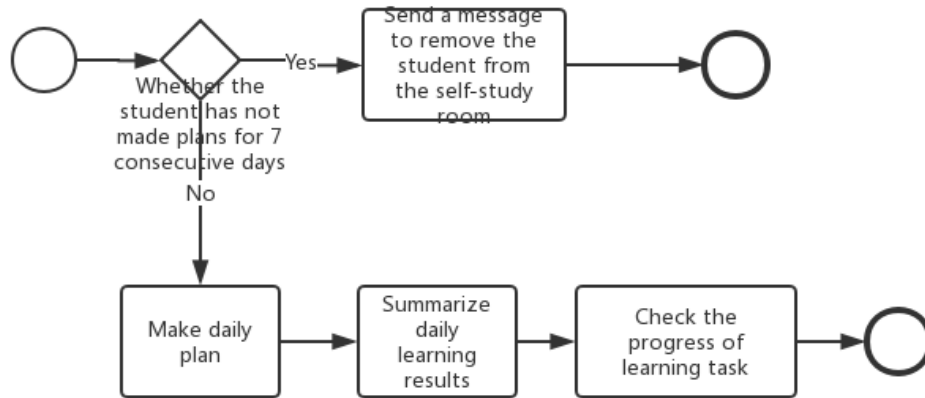


Fig. 14. Learning Task Service BPMN Model

```
<bpmn:process id="Process_3" isExecutable="true">
  <bpmn:startEvent id="StartEvent_1">
    <bpmn:outgoing>SequenceFlow_1</bpmn:outgoing>
  </bpmn:startEvent>
  <bpmn:exclusiveGateway id="ExclusiveGateway_1">
    <bpmn:incoming>SequenceFlow_1</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_4</bpmn:outgoing>
    <bpmn:outgoing>SequenceFlow_2</bpmn:outgoing>
  </bpmn:exclusiveGateway>
  <bpmn:sequenceFlow id="SequenceFlow_1" sourceRef="StartEvent_1"
    targetRef="ExclusiveGateway_1" />
  <bpmn:task id="Task_1" name="Send a message to remove the student
    from the self-study room">
    <bpmn:incoming>SequenceFlow_2</bpmn:incoming>
```

```

        <bpmn:outgoing>SequenceFlow_3</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_2" sourceRef="
        ExclusiveGateway_1"
        targetRef="Task_1">
        <bpmn:conditionExpression
            xsi:type="bpmn:tFormalExpression">Yes</bpmn:
            conditionExpression>
    </bpmn:sequenceFlow>
    <bpmn:endEvent id="EndEvent_1">
        <bpmn:incoming>SequenceFlow_3</bpmn:incoming>
    </bpmn:endEvent>
    <bpmn:sequenceFlow id="SequenceFlow_3" sourceRef="Task_1"
        targetRef="EndEvent_1" />
    <bpmn:task id="Task_2" name="Make daily plan">
    <bpmn:incoming>SequenceFlow_4</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_5</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_4" sourceRef="
        ExclusiveGateway_1"
        targetRef="Task_2" />
    <bpmn:task id="Task_3" name="Summarize daily learning results">
    <bpmn:incoming>SequenceFlow_5</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_6</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_5" sourceRef="Task_2"
        targetRef="Task_3" />
    <bpmn:task id="Task_4" name="Check the progress of learning task">
    <bpmn:incoming>SequenceFlow_6</bpmn:incoming>
    <bpmn:outgoing>SequenceFlow_7</bpmn:outgoing>
    </bpmn:task>
    <bpmn:sequenceFlow id="SequenceFlow_6" sourceRef="Task_3"
        targetRef="Task_4" />
    <bpmn:endEvent id="EndEvent_2">
        <bpmn:incoming>SequenceFlow_7</bpmn:incoming>
    </bpmn:endEvent>
    <bpmn:sequenceFlow id="SequenceFlow_7" sourceRef="Task_4"
        targetRef="EndEvent_2" />
</bpmn:process>

```