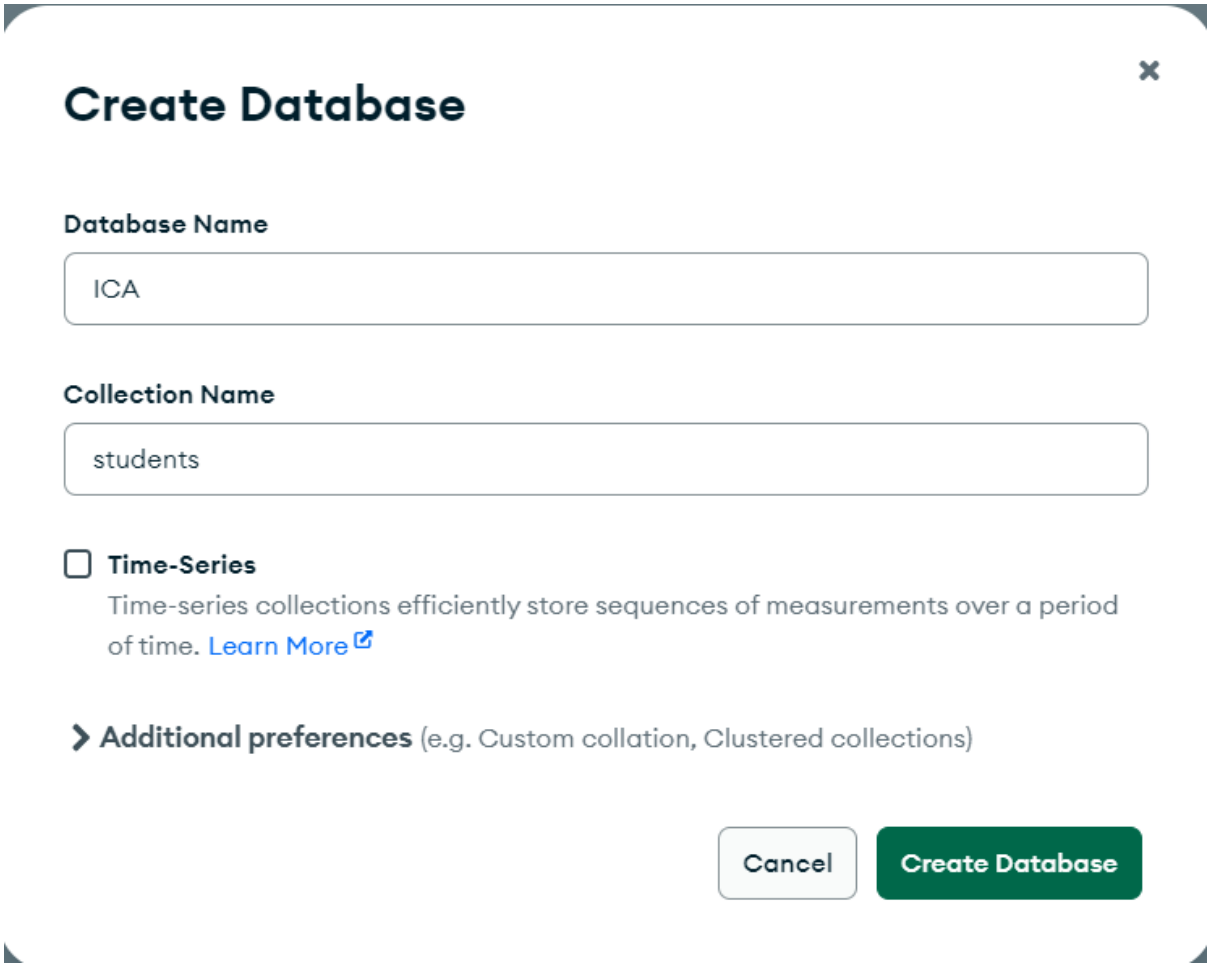
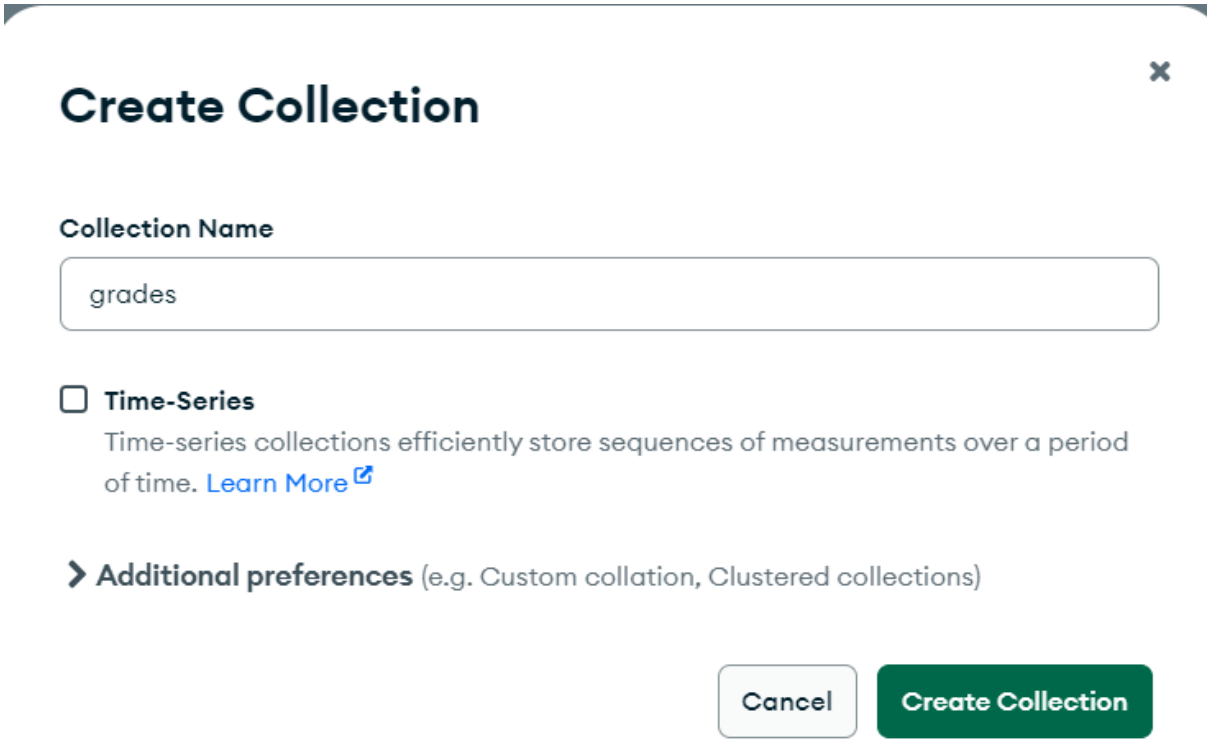
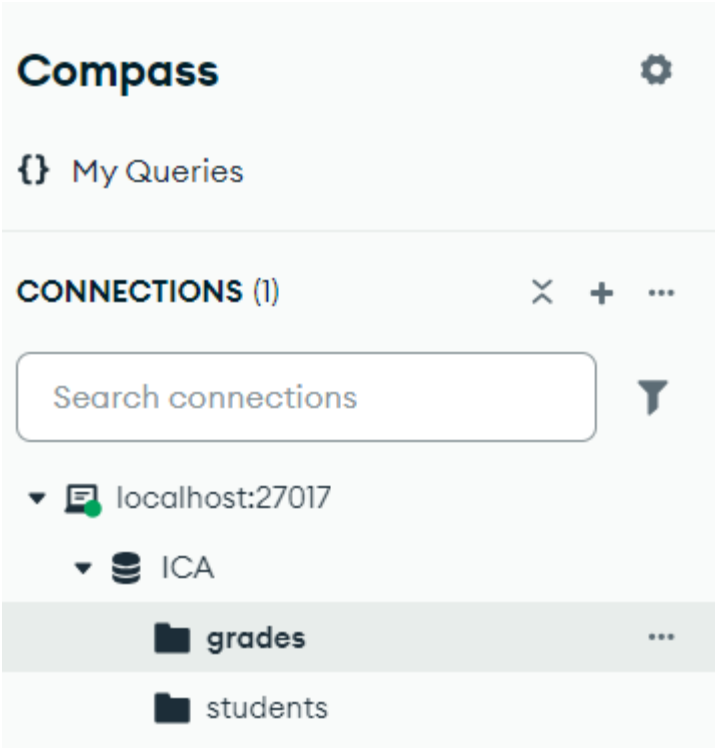
1. Create the students and grades collections and insert the sample documents into both collections.







use ICA

db.students.insertMany([

{ _id: ObjectId("64b1fcd1f4a13a001e3d41a1"), name: "Alice Johnson", enrollmentYear: 2021, major: "Computer Science", email: "alice.johnson@example.com", gender: "Female", age: 20 },

{ _id: ObjectId("64b1fcd1f4a13a001e3d41a2"), name: "Bob Smith", enrollmentYear: 2020, major: "Mathematics", email: "bob.smith@example.com", gender: "Male", age: 22 },

{ _id: ObjectId("64b1fcd1f4a13a001e3d41a3"), name: "Clara Lee", enrollmentYear: 2022, major: "Physics", email: "clara.lee@example.com", gender: "Female", age: 19 },

{ _id: ObjectId("64b1fcd1f4a13a001e3d41a4"), name: "Daniel Kim", enrollmentYear: 2021, major: "Engineering", email: "daniel.kim@example.com", gender: "Male", age: 21 },

{ _id: ObjectId("64b1fcd1f4a13a001e3d41a5"), name: "Eva Chen", enrollmentYear: 2020, major: "Biology", email: "eva.chen@example.com", gender: "Female", age: 23 },

{ _id: ObjectId("64b1fcd1f4a13a001e3d41a6"), name: "Frank Wright", enrollmentYear: 2019, major: "Chemistry", email: "frank.wright@example.com", gender: "Male", age: 24 },

{ _id: ObjectId("64b1fcd1f4a13a001e3d41a7"), name: "Grace Liu", enrollmentYear: 2022, major: "Economics", email: "grace.liu@example.com", gender: "Female", age: 20 },

{ _id: ObjectId("64b1fcd1f4a13a001e3d41a8"), name: "Henry Davis", enrollmentYear: 2021, major: "Philosophy", email: "henry.davis@example.com", gender: "Male", age: 22 },

{ _id: ObjectId("64b1fcd1f4a13a001e3d41a9"), name: "Ivy Zhang", enrollmentYear: 2020, major: "Statistics", email: "ivy.zhang@example.com", gender: "Female", age: 21 },

```
  { _id: ObjectId("64b1fcd1f4a13a001e3d41aa"), name: "Jack Lee", enrollmentYear: 2023, major: "Business", email: "jack.lee@example.com", gender: "Male", age: 18 }

]);


db.grades.insertMany([

  { subject: "Mathematics", score: 85, term: "Fall 2022", studentId: ObjectId("64b1fcd1f4a13a001e3d41a1") },

  { subject: "English", score: 90, term: "Fall 2022", studentId: ObjectId("64b1fcd1f4a13a001e3d41a1") },


  { subject: "Mathematics", score: 75, term: "Spring 2022", studentId: ObjectId("64b1fcd1f4a13a001e3d41a2") },

  { subject: "Statistics", score: 80, term: "Fall 2022", studentId: ObjectId("64b1fcd1f4a13a001e3d41a2") },


  { subject: "Physics", score: 92, term: "Fall 2022", studentId: ObjectId("64b1fcd1f4a13a001e3d41a3") },

  { subject: "Mathematics", score: 86, term: "Spring 2023", studentId: ObjectId("64b1fcd1f4a13a001e3d41a3") },


  { subject: "Engineering", score: 89, term: "Fall 2021", studentId: ObjectId("64b1fcd1f4a13a001e3d41a4") },

  { subject: "Mathematics", score: 84, term: "Spring 2022", studentId: ObjectId("64b1fcd1f4a13a001e3d41a4") },


  { subject: "Biology", score: 78, term: "Spring 2021", studentId: ObjectId("64b1fcd1f4a13a001e3d41a5") },

  { subject: "Chemistry", score: 82, term: "Fall 2021", studentId: ObjectId("64b1fcd1f4a13a001e3d41a5") },


  { subject: "Chemistry", score: 88, term: "Fall 2021", studentId: ObjectId("64b1fcd1f4a13a001e3d41a6") },

  { subject: "Physics", score: 79, term: "Spring 2022", studentId: ObjectId("64b1fcd1f4a13a001e3d41a6") },


  { subject: "Economics", score: 83, term: "Spring 2023", studentId: ObjectId("64b1fcd1f4a13a001e3d41a7") },
```

```
        { subject: "English", score: 89, term: "Fall 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a7") },


        { subject: "Philosophy", score: 91, term: "Fall 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a8") },

        { subject: "History", score: 77, term: "Spring 2023", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a8") },


        { subject: "Statistics", score: 79, term: "Spring 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a9") },

        { subject: "Data Science", score: 88, term: "Fall 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a9") },


        { subject: "Business", score: 87, term: "Fall 2023", studentId:
ObjectId("64b1fcd1f4a13a001e3d41aa") },

        { subject: "Finance", score: 82, term: "Spring 2024", studentId:
ObjectId("64b1fcd1f4a13a001e3d41aa") }

      ]);
```

```
< {
    acknowledged: true,
    insertedIds: {
      '0': ObjectId('68296d028cbcf853a5b96577'),
      '1': ObjectId('68296d028cbcf853a5b96578'),
      '2': ObjectId('68296d028cbcf853a5b96579'),
      '3': ObjectId('68296d028cbcf853a5b9657a'),
      '4': ObjectId('68296d028cbcf853a5b9657b'),
      '5': ObjectId('68296d028cbcf853a5b9657c'),
      '6': ObjectId('68296d028cbcf853a5b9657d'),
      '7': ObjectId('68296d028cbcf853a5b9657e'),
      '8': ObjectId('68296d028cbcf853a5b9657f'),
      '9': ObjectId('68296d028cbcf853a5b96580'),
      '10': ObjectId('68296d028cbcf853a5b96581'),
      '11': ObjectId('68296d028cbcf853a5b96582'),
      '12': ObjectId('68296d028cbcf853a5b96583'),
      '13': ObjectId('68296d028cbcf853a5b96584'),
      '14': ObjectId('68296d028cbcf853a5b96585'),
      '15': ObjectId('68296d028cbcf853a5b96586'),
      '16': ObjectId('68296d028cbcf853a5b96587'),
      '17': ObjectId('68296d028cbcf853a5b96588'),
      '18': ObjectId('68296d028cbcf853a5b96589'),
      '19': ObjectId('68296d028cbcf853a5b9658a')
    }
  }
ICA>
```

```
>_MONGOSH
> db.students.insertMany([
    { _id: ObjectId("64b1fcd1f4a13a001e3d41a1"), name: "Alice Johnson", enrollmentYear: 2021, major: "Computer Science", email: "alice.johns
    { _id: ObjectId("64b1fcd1f4a13a001e3d41a2"), name: "Bob Smith", enrollmentYear: 2020, major: "Mathematics", email: "bob.smith@example.co
    { _id: ObjectId("64b1fcd1f4a13a001e3d41a3"), name: "Clara Lee", enrollmentYear: 2022, major: "Physics", email: "clara.lee@example.com",
    { _id: ObjectId("64b1fcd1f4a13a001e3d41a4"), name: "Daniel Kim", enrollmentYear: 2021, major: "Engineering", email: "daniel.kim@example.
    { _id: ObjectId("64b1fcd1f4a13a001e3d41a5"), name: "Eva Chen", enrollmentYear: 2020, major: "Biology", email: "eva.chen@example.com", ge
    { _id: ObjectId("64b1fcd1f4a13a001e3d41a6"), name: "Frank Wright", enrollmentYear: 2019, major: "Chemistry", email: "frank.wright@exampl
    { _id: ObjectId("64b1fcd1f4a13a001e3d41a7"), name: "Grace Liu", enrollmentYear: 2022, major: "Economics", email: "grace.liu@example.com"
    { _id: ObjectId("64b1fcd1f4a13a001e3d41a8"), name: "Henry Davis", enrollmentYear: 2021, major: "Philosophy", email: "henry.davis@example
    { _id: ObjectId("64b1fcd1f4a13a001e3d41a9"), name: "Ivy Zhang", enrollmentYear: 2020, major: "Statistics", email: "ivy.zhang@example.com
    { _id: ObjectId("64b1fcd1f4a13a001e3d41aa"), name: "Jack Lee", enrollmentYear: 2023, major: "Business", email: "jack.lee@example.com", g
  ]);
{
  acknowledged: true,
  insertedIds: {
    '0': ObjectId('64b1fcd1f4a13a001e3d41a1'),
    '1': ObjectId('64b1fcd1f4a13a001e3d41a2'),
    '2': ObjectId('64b1fcd1f4a13a001e3d41a3'),
    '3': ObjectId('64b1fcd1f4a13a001e3d41a4'),
    '4': ObjectId('64b1fcd1f4a13a001e3d41a5'),
    '5': ObjectId('64b1fcd1f4a13a001e3d41a6'),
    '6': ObjectId('64b1fcd1f4a13a001e3d41a7'),
    '7': ObjectId('64b1fcd1f4a13a001e3d41a8'),
    '8': ObjectId('64b1fcd1f4a13a001e3d41a9'),
    '9': ObjectId('64b1fcd1f4a13a001e3d41aa')
  }
}
ICA>
```

2. Show both collections in table view.

grades

	_id ObjectId	subject String	score Int32	term String	studentId ObjectId
6	ObjectId('68296d028cbcf85…	"Mathematics"	86	"Spring 2023"	ObjectId('64b1fcd1f
7	ObjectId('68296d028cbcf85…	"Engineering"	89	"Fall 2021"	ObjectId('64b1fcd1f
8	ObjectId('68296d028cbcf85…	"Mathematics"	84	"Spring 2022"	ObjectId('64b1fcd1f
9	ObjectId('68296d028cbcf85…	"Biology"	78	"Spring 2021"	ObjectId('64b1fcd1f
10	ObjectId('68296d028cbcf85…	"Chemistry"	82	"Fall 2021"	ObjectId('64b1fcd1f
11	ObjectId('68296d028cbcf85…	"Chemistry"	88	"Fall 2021"	ObjectId('64b1fcd1f
12	ObjectId('68296d028cbcf85…	"Physics"	79	"Spring 2022"	ObjectId('64b1fcd1f
13	ObjectId('68296d028cbcf85…	"Economics"	83	"Spring 2023"	ObjectId('64b1fcd1f
14	ObjectId('68296d028cbcf85…	"English"	89	"Fall 2022"	ObjectId('64b1fcd1f
15	ObjectId('68296d028cbcf85…	"Philosophy"	91	"Fall 2022"	ObjectId('64b1fcd1f
16	ObjectId('68296d028cbcf85…	"History"	77	"Spring 2023"	ObjectId('64b1fcd1f
17	ObjectId('68296d028cbcf85…	"Statistics"	79	"Spring 2022"	ObjectId('64b1fcd1f
18	ObjectId('68296d028cbcf85…	"Data Science"	88	"Fall 2022"	ObjectId('64b1fcd1f
19	ObjectId('68296d028cbcf85…	"Business"	87	"Fall 2023"	ObjectId('64b1fcd1f
20	ObjectId('68296d028cbcf85…	"Finance"	82	"Spring 2024"	ObjectId('64b1fcd1f

students

	_id ObjectId	name String	enrollmentYear Int32	major String	email String
1	ObjectId('64b1fcd1f4a13a0…	"Alice Johnson"	2021	"Computer Science"	"alice.johnson@examp
2	ObjectId('64b1fcd1f4a13a0…	"Bob Smith"	2020	"Mathematics"	"bob.smith@example.c
3	ObjectId('64b1fcd1f4a13a0…	"Clara Lee"	2022	"Physics"	"clara.lee@example.c
4	ObjectId('64b1fcd1f4a13a0…	"Daniel Kim"	2021	"Engineering"	"daniel.kim@example.
5	ObjectId('64b1fcd1f4a13a0…	"Eva Chen"	2020	"Biology"	"eva.chen@example.co
6	ObjectId('64b1fcd1f4a13a0…	"Frank Wright"	2019	"Chemistry"	"frank.wright@exampl
7	ObjectId('64b1fcd1f4a13a0…	"Grace Liu"	2022	"Economics"	"grace.liu@example.c
8	ObjectId('64b1fcd1f4a13a0…	"Henry Davis"	2021	"Philosophy"	"henry.davis@example
9	ObjectId('64b1fcd1f4a13a0…	"Ivy Zhang"	2020	"Statistics"	"ivy.zhang@example.c
10	ObjectId('64b1fcd1f4a13a0…	"Jack Lee"	2023	"Business"	"jack.lee@example.co

3. Find the female students and only display their name, age and gender.

```
db.students.find(
  { gender: "Female" },
  { _id: 0, name: 1, age: 1, gender: 1 }
);
```

```
> db.students.find(
    { gender: "Female" },
    { _id: 0, name: 1, age: 1, gender: 1 }
  );
< {
    name: 'Alice Johnson',
    gender: 'Female',
    age: 20
  }
  {
    name: 'Clara Lee',
    gender: 'Female',
    age: 19
  }
  {
    name: 'Eva Chen',
    gender: 'Female',
    age: 23
  }
  {
    name: 'Grace Liu',
    gender: 'Female',
    age: 20
  }
  {
    name: 'Ivy Zhang',
    gender: 'Female',
    age: 21
  }
ICA>
```

4. Find the students who are younger than 22 and enrolled after 2020.

```
db.students.find(
 {
        age: { $lt: 22 },
        enrollmentYear: { $gt: 2020 }
 }
);
```

```
> db.students.find(
      {
      age: { $lt: 22 },
      enrollmentYear: { $gt: 2020 }
      }
    );
< {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a1'),
    name: 'Alice Johnson',
    enrollmentYear: 2021,
    major: 'Computer Science',
    email: 'alice.johnson@example.com',
    gender: 'Female',
    age: 20
  }
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a3'),
    name: 'Clara Lee',
    enrollmentYear: 2022,
    major: 'Physics',
    email: 'clara.lee@example.com',
    gender: 'Female',
    age: 19
  }
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a4'),
    name: 'Daniel Kim',
    enrollmentYear: 2021,
    major: 'Engineering',
    email: 'daniel.kim@example.com',
    gender: 'Male',
    age: 21
  }
```

```
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a4'),
    name: 'Daniel Kim',
    enrollmentYear: 2021,
    major: 'Engineering',
    email: 'daniel.kim@example.com',
    gender: 'Male',
    age: 21
  }
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a7'),
    name: 'Grace Liu',
    enrollmentYear: 2022,
    major: 'Economics',
    email: 'grace.liu@example.com',
    gender: 'Female',
    age: 20
  }
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41aa'),
    name: 'Jack Lee',
    enrollmentYear: 2023,
    major: 'Business',
    email: 'jack.lee@example.com',
    gender: 'Male',
    age: 18
  }
ICA>
```

5. Find all grades for "Alice Johnson".

```
const aliceId = db.students.findOne({ name: "Alice Johnson" })._id;
db.grades.find({ studentId: aliceId });
```

```
> const aliceId = db.students.findOne({ name: "Alice Johnson" })._id;
    db.grades.find({ studentId: aliceId });
< {
    _id: ObjectId('68296d028cbcf853a5b96577'),
    subject: 'Mathematics',
    score: 85,
    term: 'Fall 2022',
    studentId: ObjectId('64b1fcd1f4a13a001e3d41a1')
  }
  {
    _id: ObjectId('68296d028cbcf853a5b96578'),
    subject: 'English',
    score: 90,
    term: 'Fall 2022',
    studentId: ObjectId('64b1fcd1f4a13a001e3d41a1')
  }
ICA>
```

6. Find how many students followed the subject “Mathematics”.

```
db.grades.distinct("studentId", { subject: "Mathematics" }).length;
```

```
>
> db.grades.distinct("studentId", { subject: "Mathematics" }).length;
< 4
ICA>
```

7. Find all students with grades in the term "Fall 2022".

```
db.grades.aggregate([
 { $match: { term: "Fall 2022" } },
 {
        $lookup: {
          from: "students",
          localField: "studentId",
          foreignField: "_id",
          as: "student"
        }
```

```
  },
  { $unwind: "$student" },
  {
            $project: {
              _id: 0,
              studentName: "$student.name",
              subject: 1,
              score: 1,
              term: 1
            }
  }
]);
```

```
> db.grades.aggregate([
    { $match: { term: "Fall 2022" } },
    {
    $lookup: {
      from: "students",
      localField: "studentId",
      foreignField: "_id",
      as: "student"
    }
    },
    { $unwind: "$student" },
    {
    $project: {
      _id: 0,
      studentName: "$student.name",
      subject: 1,
      score: 1,
      term: 1
    }
    }
  ]);
< {
    subject: 'Mathematics',
    score: 85,
    term: 'Fall 2022',
    studentName: 'Alice Johnson'
  }
  {
    subject: 'English',
    score: 90,
    term: 'Fall 2022',
    studentName: 'Alice Johnson'
  }
```

```
  {
    subject: 'Statistics',
    score: 80,
    term: 'Fall 2022',
    studentName: 'Bob Smith'
  }
  {
    subject: 'Physics',
    score: 92,
    term: 'Fall 2022',
    studentName: 'Clara Lee'
  }
  {
    subject: 'English',
    score: 89,
    term: 'Fall 2022',
    studentName: 'Grace Liu'
  }
  {
    subject: 'Philosophy',
    score: 91,
    term: 'Fall 2022',
    studentName: 'Henry Davis'
  }
  {
    subject: 'Data Science',
    score: 88,
    term: 'Fall 2022',
    studentName: 'Ivy Zhang'
  }
ICA>
```