

# GIGA 端末活用実践事例

宇都宮大学共同教育学部附属中学校：指導者：菅生 崇夫

教科・領域等	学年	単元名・題材名等
理科・生物	3	生命の連続性・遺伝の規則性と遺伝子

## 1. GIGA 端末活用のポイント

### (1) 本時の目標

教科書に書かれている内容と、メンデルの行った実験の内容について論文を使って検証するとともに、実験結果などに基づいて親の形質が子に伝わる際の規則性などについて自らの考えを導き、表現することができる。

### (2) 活用アプリ

ロイロノート

### (3) GIGA 端末以外で利用した機器

### (4) アプリの活用場面と目的

オンライン       オフライン

### 授業での活用場面（授業概要）

有性生殖で親の形質が子に伝わる際の伝わり方や規則性について調べるため、メンデルによって書かれた論文を授業で紹介し、生徒がロイロノートの共有機能を使い、みんなで協力して論文を読み、論文の内容と教科書の内容を比較する授業を行った。

- 1 時限目・・・有性生殖で親の形質が子に伝わる際の伝わり方や規則性について調べる。
- 2 時限目・・・メンデルが行った実験をもとに検証実験を行い遺伝子のはたらきを調べる。
- 3 時限目・・・孫の代への形質の伝わり方について、遺伝子の組み合わせをもとにまとめる。

## 2. GIGA 端末活用の画面例（写真等）

### 生徒の活動の様子

実験の目的と計画  
ハイブリッドの形質  
ハイブリッドからの第一世代  
ハイブリッドからの第二世代  
ハイブリッドからの第三世代  
ハイブリッドからの第四世代  
ハイブリッドからの第五世代  
ハイブリッドからの第六世代  
ハイブリッドからの第七世代  
ハイブリッドからの第八世代  
ハイブリッドからの第九世代  
ハイブリッドからの第十世代

**Introductory remarks**  
selection of the experimental plants  
division and arrangement of the experiments  
the forms of the hybrids  
the first generation from the hybrids  
the second generation from the hybrids  
the subsequent generation from the hybrids  
the offspring of hybrids which several differentiating characters are associated  
the reproductive cells of the hybrids  
experiments with hybrids of other species of plants  
concluding remarks

1) 黄色と緑色の種子 (seed color) .  
2) 丸い種子としわあがる種子 (seed shape) .  
3) 黄色と緑色の花 (flower color) .  
4) 背丈が短い茎の長さ (stem length) .  
5) きやが膨らんでいるか平たいか (pod shape) .  
6) 茎の色が紫白か白か (flower color) .  
7) 花が茎の先端につくか葉の腋につくか (flower position on stem) .

This relates without exception to all the characters which were investigated in the experiments. The angular wrinkled form of the seed, the green color of the albumen, the white color of the seed-coats and the flowers, the constrictions of the pods, the yellow color of the unripe pod, of the stalk, of the calyx, and of the leaf venation, the umbel-like form of the inflorescence, and the dwarfed stem, all reappear in the numerical proportion given, without any essential alteration. *Transitional forms were not observed in any experiment.*

Since the hybrids resulting from reciprocal crosses are formed alike and present no appreciable difference in their subsequent development, consequently these results can be reckoned together in each experiment. The relative numbers which were obtained for each pair of differentiating characters are as follows:

Expt 1:	Expt 2:	Expt 3:	Expt 4:	Expt 5:	Expt 6:	Expt 7:
Form of seed	Color of albumen	Color of the unripe pod	Color of the ripe pod	Color of the stem	Position of flowers	Length of stem
From 253 hybrids 7,324 seeds were obtained in the second trial year. Among them were 5,474 round or roundish ones and 1,850 angular wrinkled ones. Therefrom the ratio of 2.96:1 is deduced. <i>e.g. 丸い種子の数は、しわあがる種子の数の約3倍である。</i>	258 plants yielded 8,023 seeds, 6,022 yellow, and 2,001 green; their ratio, therefore, is as 3.01:1. <i>e.g. 黄色の種子の数は、緑色の種子の数の約3倍である。</i>	258 plants yielded 8,023 seeds, 6,022 yellow, and 2,001 green; their ratio, therefore, is as 3.01:1. <i>e.g. 黄色の種子の数は、緑色の種子の数の約3倍である。</i>	258 plants yielded 8,023 seeds, 6,022 yellow, and 2,001 green; their ratio, therefore, is as 3.01:1. <i>e.g. 黄色の種子の数は、緑色の種子の数の約3倍である。</i>	258 plants yielded 8,023 seeds, 6,022 yellow, and 2,001 green; their ratio, therefore, is as 3.01:1. <i>e.g. 黄色の種子の数は、緑色の種子の数の約3倍である。</i>	258 plants yielded 8,023 seeds, 6,022 yellow, and 2,001 green; their ratio, therefore, is as 3.01:1. <i>e.g. 黄色の種子の数は、緑色の種子の数の約3倍である。</i>	258 plants yielded 8,023 seeds, 6,022 yellow, and 2,001 green; their ratio, therefore, is as 3.01:1. <i>e.g. 黄色の種子の数は、緑色の種子の数の約3倍である。</i>

As extremes in the distribution of the two seed characters in one plant, there were observed in Expt. 1 an instance of 43 round and only two angular, and another of 14 round and 13 angular seeds. In Expt. 2 there was a case of 32 yellow and only one green seed, but also one of 20 yellow and 19 green.

These two experiments are important for the determination of the average ratios, because with a smaller number of experimental plants they show that very considerable fluctuations may occur. In counting the seeds also, especially in Expt. 1, some care is requisite, since in some of the seeds of many plants the green color of the albumen is less developed, and at first may be easily overlooked. The cause of this partial disappearance of the green coloring has no connection with the hybrid-character of the plants, as it likewise occurs in the parental variety. This peculiarity is also confined to the individual and is not inherited by the offspring. In luxuriant plants this appearance was frequently noted. Seeds which are damaged by insects destroy their development often vary in color and form, but with a little practice in sorting, errors are easily avoided. It is almost superfluous to mention that the pods may remain on the plants until they are thoroughly ripened and have become dried, since it is only then that the shape and color of the seeds are fully developed.

Expt 3: Color of the seed-coats. — Among 929 plants, 705 bore wrinkled flowers and gray-white seed-coats, 224 bore smooth flowers and white seed-coats, giving the proportion of 3.12:1. *丸い花としわあがる種子の数は、滑らかな花と白い種子の数の約3倍である。*

Expt 4: Form of pods. — Of 1,181 plants, 882 had them simply inflated, and 299 were constricted. Resulting ratio, 2.95:1.

Expt 5: Color of the unripe pods. — The number of trial plants was 580, of which 438 had green pods and 142 yellow ones. Consequently these stand in the ratio of 3.08:1. *緑色の未熟な豆の数は、黄色の未熟な豆の数の約3倍である。*

Expt 6: Position of flowers. — Among 258 cases 251 had inflorescences axillary and 7 terminal. Ratio, 35.4:1. *腋生花の数は、頂生花の数の約35倍である。*

Expt 7: Length of stem. — Out of 1,064 plants, in 783 cases the stem was long, and in 277 short. Hence a mutual ratio of 2.81:1. In this experiment the dwarfed plants were carefully lifted and transferred to a special bed. This precaution was necessary, as otherwise they would have perished through being overgrown by their tall relatives. Even in their quite young state they can be easily picked out by their compact growth and thick dark-green foliage.

If now the results of the whole of the experiments be brought together, there is found, as between the number of forms with the dominant and recessive characters, an average ratio of 2.98:1, or 3:1. The dominant character can have here a double signification — viz. that of a parental character or a hybrid-character. In which of the two significations it appears in each separate case can only be determined by the following generation. As a parental character it must pass over unchanged to the whole of the offspring, as a hybrid-character, on the other hand, it must maintain the same behavior as in the first generation.

**THE SECOND GENERATION FROM THE HYBRIDS**

Those forms which in the first generation exhibit the recessive character do not further vary in the second generation as regards this character; they remain constant in their offspring.

It is otherwise with those which possess the dominant character in the first generation [bred from the hybrids — i.e. the F<sub>2</sub> in modern terminology]. Of these two-thirds yield offspring which display the dominant and recessive characters in the proportion of three to one, and thereby show exactly the same ratio as the hybrid forms, while only one-third remains with the dominant character constant.

### 3. 効果と課題

#### (1) GIGA 端末 (アプリ) を活用して効果的だった点

一斉学習	<input checked="" type="checkbox"/>	教師による教材の提示				
個別学習	<input checked="" type="checkbox"/>	個に応じた学習	<input type="checkbox"/>	調査活動	<input type="checkbox"/>	思考を深める学習
	<input type="checkbox"/>	表現・制作	<input type="checkbox"/>	家庭学習	<input type="checkbox"/>	
協働学習	<input type="checkbox"/>	発表や話し合い	<input checked="" type="checkbox"/>	協働での意見整理	<input checked="" type="checkbox"/>	協働制作
	<input type="checkbox"/>	学校間の交流	<input type="checkbox"/>	家庭学習	<input type="checkbox"/>	

これまでは、生徒に論文を印刷して配ることを考えたとき、教師の労力が大きいため断念してしまうこともあったかと思うが、ICT を活用することによりプリントを印刷する手間も、配付する手間もない。また、今回の使ったロイロノートの共有機能は、1つのシートを全員で操作することが可能なため、論文は英語で書かれているものの、英語が苦手な生徒も一緒に内容を理解することが可能になった。大切な部分にラインを引くことで重要な部分を知ることができ、単語やヒントを書き込みながら読み進めていくことができる。

#### (2) GIGA 端末 (アプリ) を活用して課題に感じた点

一斉学習	<input type="checkbox"/>	教師による教材の提示				
個別学習	<input checked="" type="checkbox"/>	個に応じた学習	<input type="checkbox"/>	調査活動	<input type="checkbox"/>	思考を深める学習
	<input type="checkbox"/>	表現・制作	<input type="checkbox"/>	家庭学習	<input type="checkbox"/>	
協働学習	<input checked="" type="checkbox"/>	発表や話し合い	<input type="checkbox"/>	協働での意見整理	<input type="checkbox"/>	協働制作
	<input type="checkbox"/>	学校間の交流	<input type="checkbox"/>	家庭学習	<input type="checkbox"/>	

ネット環境に左右されてしまうことや、共有ノートを活用した授業であったため、自分がやらなくても周りの子がやってくれて内容がわかってしまうことがある。活動の際の事前確認が必要だと考える。