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Observing and Sketching Skills in Plant Anatomy Practical Class

Kemahiran Memerhati dan Melakar dalam Kelas Amali Anatomi Tumbuhan

Fatimah Mohamed[1], Tan Shu Wei & Nor Nafizah Mohd Noor
Department of Biology, Faculty of Science and Mathematics,
Universiti Pendidikan Sultan Idris, 35900 Tanjong Malim, Perak
[1]E-mail: fatimah@fsmt.upsi.edu.my

Abstract

The purpose of this descriptive study was to evaluate the intellectual level of application in observing and sketching skills in laboratory practical class of Biology and Agricultural Science first year student teachers at Universiti Pendidikan Sultan Idris. It was conducted to find means to improve the learning of plant anatomy by determining observing and sketching skills. A total of 40 student teachers were given monocotyledon (*Zea mays*) and dicotyledon (*Helianthus* sp.) leaf cross-section slides, which were then observed under the microscope and the images, were sketched. These skills were evaluated using two performance indicator scales data sheet modified from performance indicator scales modified from the *Pentaksiran Kerja Amali Biologi SPM* (*PEKA*) and were analysed using SPSS 16.0 for Windows. The result of the research showed that the level of application for observing skill was moderately high (mean = 2.08, SD = 0.7), while the level of application for sketching skill was moderately low (mean = 1.40, SD = 0.7). The relationship between these two skills was evaluated using Pearson Correlation analysis and there was no significant relationship between the observing and sketching skills ($r = -0.010$, $p = 0.952$). This study concludes that the first year student teachers are inadequate of both skills and implicates the lack of understanding for this course. It is recommended that the student teachers should be taught both skills prior to the course.

Keywords Observing skill, sketching skill, plant anatomy laboratory practical class, plant morphology

Abstrak

Kajian deskriptif ini bertujuan untuk menilai tahap penggunaan kemahiran memerhati dan melakar dalam kerja amali di makmal bagi pelajar guru tahun satu Biologi dan Sains Pertanian di Universiti Pendidikan Sultan Idris. Kajian dijalankan khusus untuk merangka penambahbaikan pembelajaran Anatomi Tumbuhan dengan mengenal pasti kemahiran memerhati dan melakar. Sejumlah 40 orang pelajar guru telah diberikan slaid keratan rentas daun monokotiledon (*Zea mays*) dan dikotiledon (*Helianthus* sp.) yang diperhatikan di bawah mikroskop dan imejnya dilakar. Kemahiran memerhati dan melakar pelajar guru dinilai dengan menggunakan dua skala petunjuk prestasi yang diubah suai daripada Pentaksiran Kerja Amali Biologi SPM (PEKA) dan dianalisis menggunakan *SPSS 16.0 for Windows*). Dapatan kajian menunjukkan bahawa tahap penggunaan kemahiran memerhati adalah sederhana tinggi (min = 2.08, SP = 0.7), manakala tahap kemahiran melakar adalah sederhana rendah (min = 1.40, SP = 0.7). Hubungan di antara kedua-dua kemahiran ini dinilai menggunaan analisis Korelasi Pearson dan didapati tidak terdapat hubungan yang

signifikan di antara kemahiran memerhati dan melakar (r = -0.010, p = 0.952). Kajian ini menyimpulkan bahawa pelajar guru tahun satu Biologi dan Sains Pertanian tidak mempunyai cukup kemahiran dalam memerhati dan melakar. Implikasinya ialah mereka tidak mempunyai kefahaman pada tahap yang baik untuk kursus ini. Adalah dicadangkan pelajar guru perlu diajar kedua-dua kemahiran tersebut sebelum mengikuti kursus ini.

Kata kunci Kemahiran memerhati, kemahiran melakar, kelas amali anatomi tumbuhan, morfologi

Introduction

An increased attention has been emphasized on the future teachers' Science Process Skills abilities. Thus, this study was aimed to address these questions; (a) Are the student teachers lacking the ability in critical observing and sketching skills of plant anatomy specimens under the microscope, (b) What are their application level of these skills, and (c) Is there any relationship between the application of both skills. Furthermore, our concern is to detect all possibilities that might have incurred due to the incapability of observing and sketching. Through our observations, most of the first year student teachers are found to be incompetent and uncomfortable when they are asked to use microscope during the practical probably due to insufficient experience on what to be observed and sketched.

The Science Process Skills (SPS) include thinking systematically and objectively, and the ability to analyse rationally can affect student teachers' achievements. Gagne (1965) believed that SPS were global skills that can be applied in other disciplines. In addition, manipulative skill which is the element in SPS also includes all the techniques and methods in handling correctly the science instruments (Poh, 2001). In order to produce quality science teachers, every student teacher should be well equipped with quality knowledge and competent manipulative skills. Plant Morphology and Anatomy is one of the courses offered at UPSI as part of the fulfillment for Bachelor of Education (Biology and Agricultural Science) and manipulative skills such as observing and sketching are highly required. Student teachers can only acquire these two closely related skills when their skill in observing and sketching specimens under microscope are carefully and critically observed. Only then, the understanding of the details of the tissue in the plant section can be portrayed through critical illustration and vice versa (Shaw *et al*., 1999). Therefore, this study is conducted to identify the level of observing and sketching skills among student teachers and to determine the relationship between these two skills.

Methodology

Sample

This study was conducted in Universiti Pendidikan Sultan Idris. A total of forty first year student teachers of Biology and Agricultural Science were chosen randomly. The study was conducted during Plant Morphology and Anatomy laboratory in several practical sessions.

Measuring the observation and sketching ability

The student teachers were given permanent slides of leaf cross-section of *Zea mays* and *Helianthus* sp. They were instructed to observe and sketch the vessel elements, phloem,

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epidermis, palisade and spongy mesophylls, and trichomes seen under the microscope. Their ability to observe and sketch were measured using two performance indicator scales modified from the *Pentaksiran Kerja Amali Biologi SPM* (PEKA)(Kementerian Pendidikan Malaysia, 2004) shown in Table 1, Table 2 and Table 3. Table 1 shows how the score of each performance in Table 2 and 3 were made. Both application levels of observing and sketching were analysed based on the mean scores, while Pearson correlation was applied to evaluate the relationship for both skills application. In addition, a modified Nunally and Berstein (1994) table of interpretation was used in determining the level of observing and sketching skills as shown in Table 4.

Table 1 Score of performance indicator

Score	Performance indicator
3	Mastering in all performance indicators correctly.
2	Mastering in any two performance indicators correctly.
1	Mastering in any one of the performance indicators correctly.
0	Not mastering in all performance indicators correctly.

Table 2 Ability in observing skill on the cross-section of monocotyledon and dicotyledon leaves

Score	Criteria of observing skill
1	Ability to identify and focus on relevant details on the tissue characteristics such as stoma, epidermis, mesophylls, xylem, phloem and vascular bundle distribution in the leaf cross-sectioned of monocotyledon and dicotyledon.
2	Ability to identify diagnostic characters on the leaf cross-sectioned of monocotyledon and dicotyledon.
3	Ability to compare and contrast both leaf sections.

Table 3 Ability in sketching skill on the cross-section of monocotyledon and dicotyledon leaves

Score	Criteria of sketching skill
1	Ability to sketch clearly and correctly based on the structure and function of each tissues (e.g. xylem with two lines that the inner line shows lumen, phloem with one line and two different sizes of sieve and companion cells).
2	Ability to sketch in appropriate size of each tissues (e.g. xylem is relatively bigger than phloem).
3	Ability to sketch clearly with sharp and smooth line, and without shading.

Table 4 Application levels of observing and sketching skills based on mean value score analysis

Mean value	Application level indicator
0.00 – 1.00	Low
1.01 – 2.00	Medium low
2.01 – 3.00	Medium high
3.01 – 4.00	High

(Source : Modified from Nunally & Berstein, 1994)

Each score in Table 1 was used in student teachers' evaluation for both skills as shown in Table 2 and 3. The observing skill was observed during the practical sessions. The sketching skill was evaluated during practical sessions and based on the practical reports. Student teachers who obtained 0 score do not fulfil all the skills in Table 2 and Table 3. Score 1 was given to student teachers that fulfilled one of the skills, score 2 for student teachers that fulfilled any two of the skills, and score 3 was given to student teachers that fulfilled all the skills.

Results and Discussion

Figure 1 shows the student teacher's level of observing skills while the level for sketching skills as shown in Figure 2.

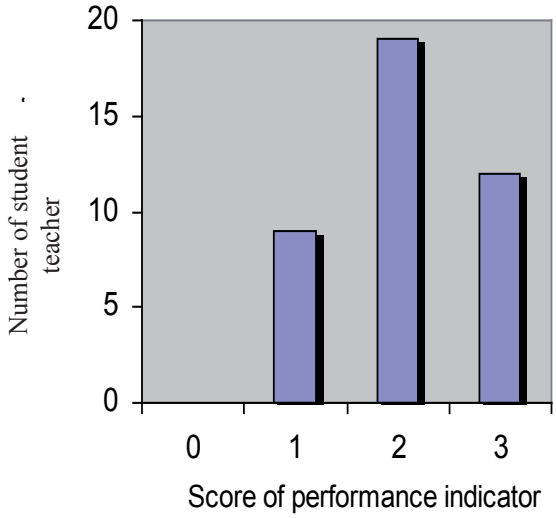

Figure 1 Number of student teacher at each level of observing skill application

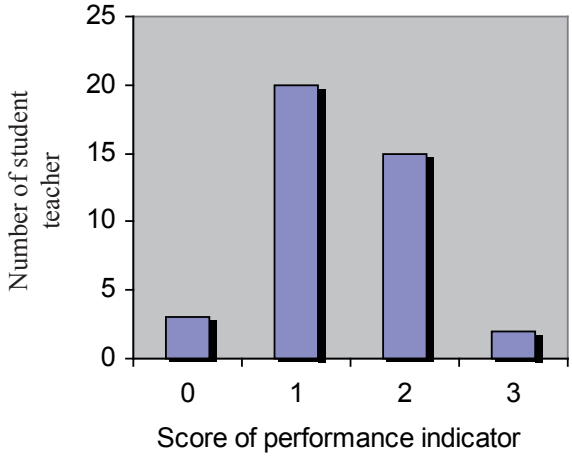

Figure 2 Number of student teacher at each level of sketching skill application

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Out of the 40 student teachers, there were 9 (22.5%) of the student teachers master at least one of the observing skill abilities, 19 (47.5%) were able to perform any two of the observing skill abilities, and 12 (30.0%) could performed all the observing skill abilities. None of the student teachers scored 0 for observing skill abilities (Figure 1).

The student teachers performance on sketching skill abilities showed that 3 (7.5%) of the student teachers possess none of these abilities, 20 (50.0%) were able to perform at least one of the sketching skill abilities, 37.5% (15 student teachers) could perform two of the sketching skills abilities, and 5.0% (2 student teachers) successfully performed all the sketching skills abilities (Figure 2). The results indicated that the student teachers have better observing skills compared to sketching skills.

Based on the scale described by Nunally and Berstein (1994), the level of application for observation skill among these student teachers is moderately high (mean = 2.08, SD = 0.7), while the level of application for sketching skill is moderately low (mean = 1.40, SD = 0.7).

A sketch by a student teacher with zero score as shown in Figure 3. This student teacher did not possesses both observing and sketching skills as he/she was unable to determine the cells' shape of vascular bundle tissue. The cells were sketched in loose form arrangement while the palisade cells without complete cell wall outline. The sketch did not represent the exact structure and function of the leaf cross-section. Furthermore, the tissues drawn were not labelled. These indicated not only that this student teacher was unable to sketch but also failed to relate the sketch to the theory. It was also observed that some of them simply sketch by copying what others had drawn.

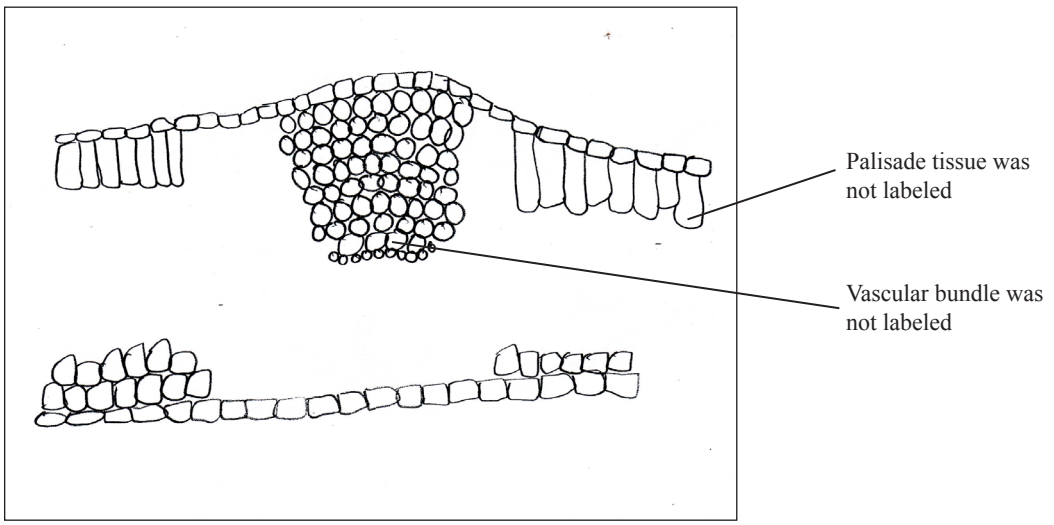

Figure 3 Example of *Helianthus* leaf cross-section sketched by student teacher with score 0

Student teachers with score 1 had mastered one of the sketching skill abilities and the sketch sample is shown in Figure 4. The student teacher was able to sketch the tissue distribution correctly but not the tissues. From the sketch, this student teacher was found to possess some knowledge on the function of the tissues as he/she had labelled them correctly, but failed to draw them as a complete cell. The palisade cells were drawn with incomplete cell wall outline.

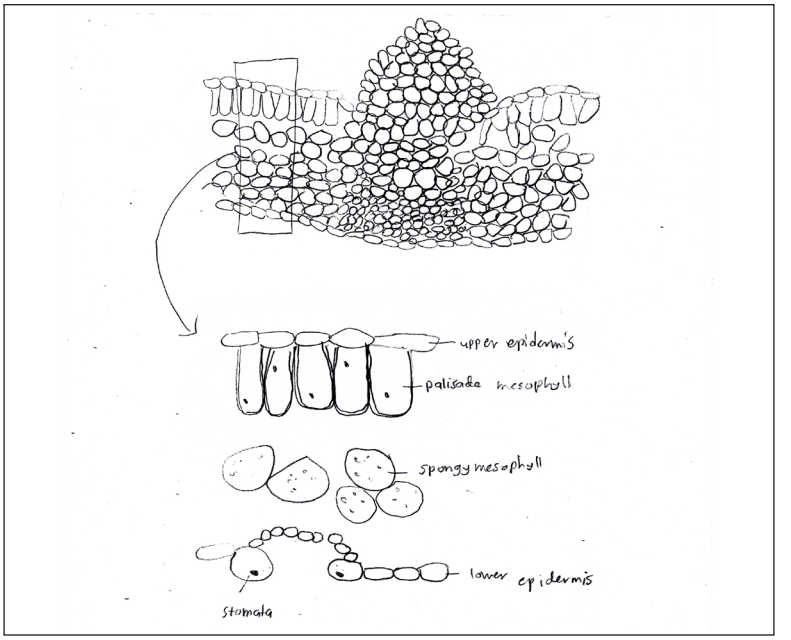

Figure 4 Example of *Helianthus* leaf cross-sectioned sketched by a student teacher with score 1

The student teachers with score 2, had mastered any two of the sketching skill abilities. For example in the sketch, the student teacher was identified as able to draw the tissues in the right distribution, correct size, and the cell as individual cell. The student teacher was not able to sketch the content of the cell. Subsequently, he/she was detected as unable to show the cell function (Figure 5).

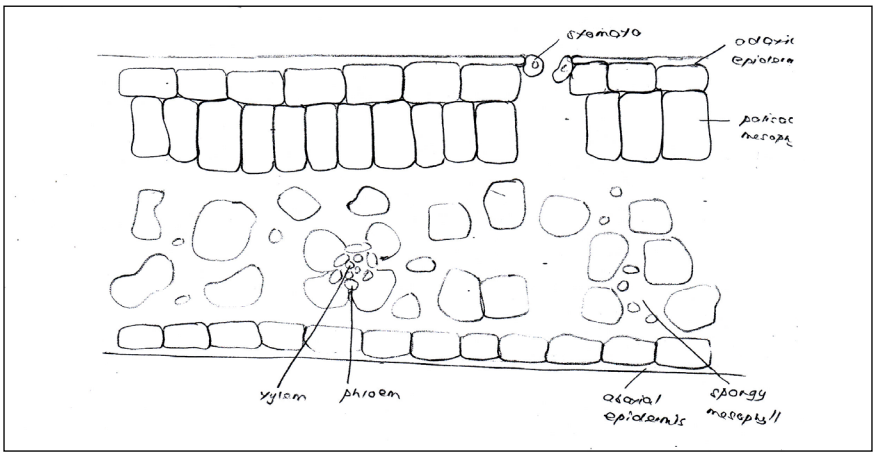

Figure 5 Example of Helianthus leaf cross-section sketched by a student teacher with score 2

The student teacher who obtained score 3 had mastered all the sketching skill abilities. The tissue was drawn according to their shape, size, distribution and the cell content (Figure 6). On top of that, the distribution, shape, and function of the tissues were showed correctly. Eventually the sketch was labelled correctly.

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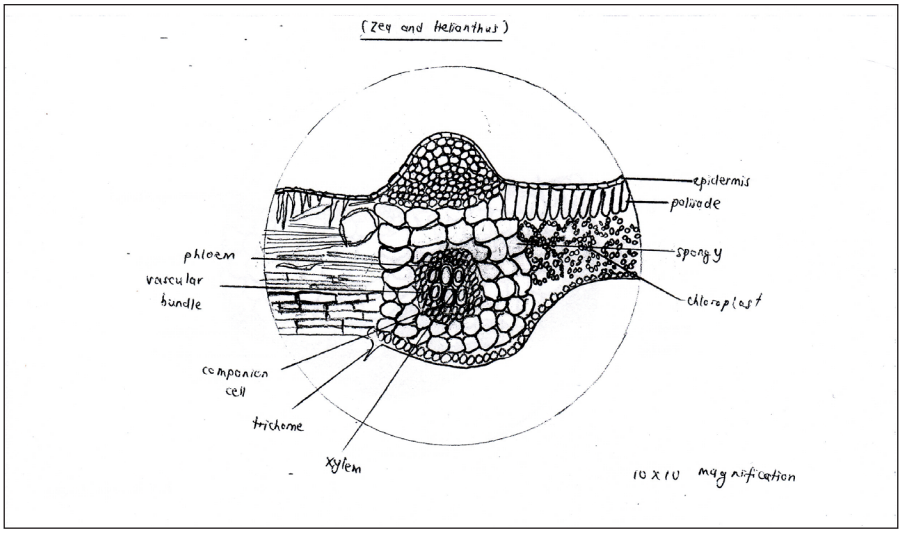

Figure 6 Example of *Helianthus* leaf cross-sectioned sketched by a student teacher with score 3

However, in a practical class, it is a good practise that only a few cells are sketched and suffice to represent each tissue. The sketch of the leaf anatomy should have all the details and all important tissues should be magnified, as shown in Figure 7. The author's sketch showed that only important cells were sketched with appropriate scale. The area consists of parenchyma cells is omitted, while the area with repeating cells type is represented by map outline (refer to the circle surrounded the sieve and companion cells) or dots.

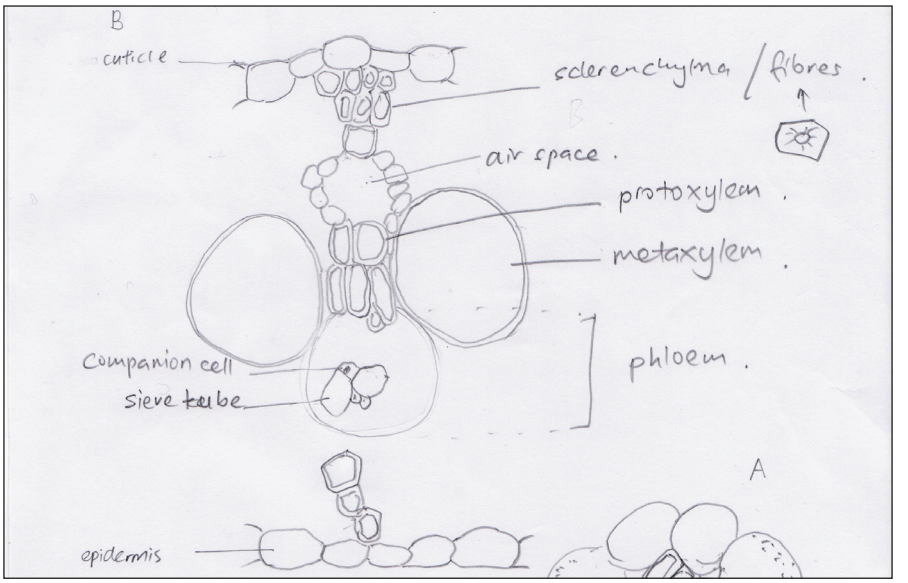

Figure 7 Example of *Zea mays* leaf cross-section sketched by the author

This study reveals that there is no statistical significant difference between the application level of observing and sketching skills ability in plant tissues observed under the microscope (Table 5). Therefore, there is no relationship between both skills application level. The level of observing and sketching skills showed medium high (Figure 1) and

medium low score (Figure 2), respectively. This study showed that most of the student teachers were able to identify and what to observe during the Plant Anatomy practical class. According to *Pusat Perkembangan Kurikulum* (2001), the ability to observe depends on how students gather information through senses, such as seeing, listening, sensoring, tasting or smelling. Upon acquiring the critical observing skill ability, the student teacher's attitude towards the course will change positively (Mohd Ali & Rohiza, 2010).

Table 5 Correlationship between observing and sketching skills

		Observing Skill	Sketching Skill
Observing Skill	Pearson correlation	1	-0.010
	Sig. (2-tails)		0.952
	N	40	40
Sketching Skill	Pearson correlation	-0.010	1
	Sig. (2-tails)	0.952	
	N	40	40

In addition, those who can sketch with score 3 supposed to have the ability in critical observation skills, and vice versa. In other words, sketching skill is supposed to be related to observing skills. It is not in line with findings by Chun & Yu (2002) when they found that when students could perform critical observing skills, they also showed strong ability to define information they gathered. This study showed that there is no relationship between the two skills. The findings could be explained by inferring to research done by Che Haniza (2011) and Noor Fadilah (2011). They reported that since in primary school, Malaysian students were exposed to observing skills and labelling diagrams but sketching skills are only taught in Art classes. In Art classes, diagrams are sketched with emphasize on the angle's view, artistic aspects, and shadowing while the details are not the main aspects taught. Since the study was conducted during the first practical session and for the first year student teachers, the results could be explained according to Kolb *et al*. (2002). In their study, they conclude that experiences during information gathering could help students to increase the power of mind in learning new things. The student teachers are probably inexperienced, and therefore few exercises on observing and sketching skills are required and should be conducted utilizing more plant cross-section samples in order to investigate the relationship of these two skills.

To secure and instil observing and sketching skills among the future teacher, these skills should be implemented across all science subjects especially in this course. The student teachers should be made to know what to observe and to be taught on sketching techniques in order to understand the plant tissues and functions. These should be done prior and after the practical classes.

Conclusion

Student teachers show moderately high scores in skill level of observation, while moderately low in the level of sketching skill; indicating that student teacher know what they have observed but lacked of the skill to sketch. We conclude that manipulative skills such as observing and sketching are important and should be emphasized in learning science. It is recommended that student teachers should be exposed to a series of exercises on how to observe critically and sketch skilfully in order to master this course.

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